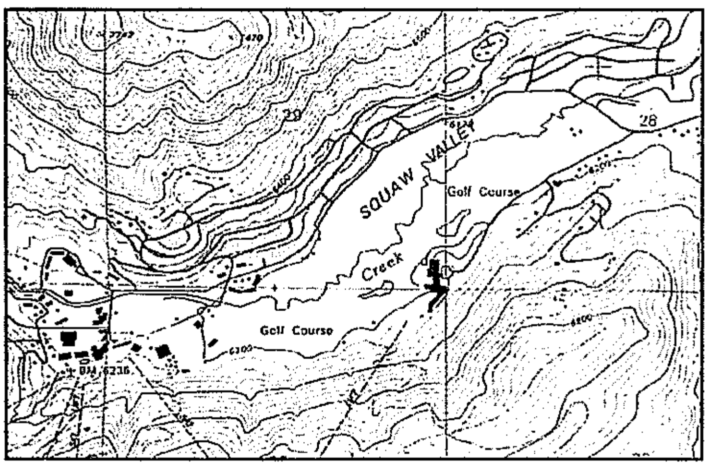
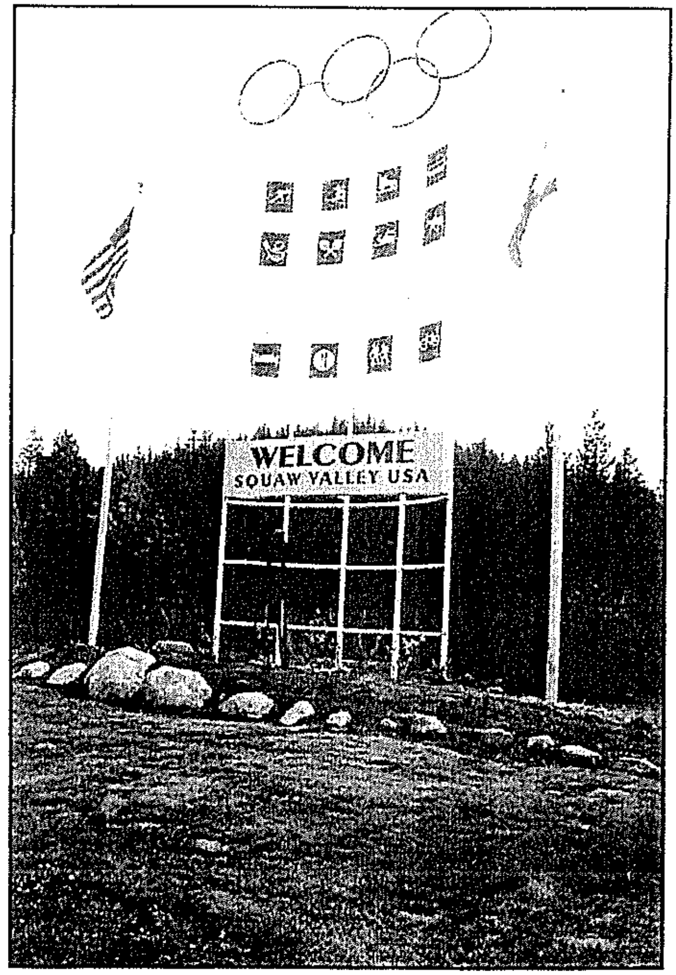
APPENDIX G

GROUNDWATER DEVELOPMENT AND UTILIZATION FEASIBILITY STUDY; AQUIFER TESTING AND IMPACT ANALYSIS

C0121 #3

SQUAW VALLEY
PUBLIC SERVICE DISTRICT





WEST YOST & ASSOCIATES
Consulting Engineers

October 2001

SQUAW VALLEY GROUNDWATER DEVELOPMENT & UTILIZATION FEASIBILITY STUDY

Squaw Valley
Groundwater Development & Utilization Feasibility Study

Prepared for
Squaw Valley Public Service District

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033-99-03.10

EXECUTIVE SUMMARY

PROJECT BACKGROUND AND OBJECTIVES

In the past ten years, there has been a significant development within Squaw Valley and as a result, water supply requirements have increased. The Squaw Valley Public Service District's (District) 1993 Water Master Plan, which has been used by the District to guide the orderly expansion of the water system, included recommendations for the collection of additional hydrogeologic data and the development of a groundwater management program for the valley. The scope of the recommended study also included the determination of the sustained yield of the basin to confirm adequate water supply will be available to meet the increased demands associated with the buildout of Squaw Valley's General Plan.

Over the past twenty years several studies have estimated the yield of the groundwater basin. These studies were based on very limited information and many simplifying assumptions to arrive at the estimated recoverable yield of the basin. The experience during the sustained drought period of 1987 through 1992 showed that the groundwater resource is capable of supplying current demands without exhibiting sustained overdrafting. However, there is concern about the capability of the groundwater basin to provide sufficient good quality water to supply increasing future demands. In addition, there is the need to replace the existing wells that are more than 40 years old and require increasing rehabilitation efforts to maintain their water production capabilities.

The groundwater basin west of the golf course provides good quality water that meets all primary and secondary drinking water standards. The watershed boundary and location map of Squaw Valley are shown on Figure ES-1. The groundwater in the rest of the basin is of lower quality due to the geology and highly mineralized geothermal springs. A number of wells have been drilled recently that have produced water with high iron and manganese concentrations that will require treatment prior to being distributed for consumption. The District is also concerned that the current supply meet future drinking water standards for radon and arsenic.

The District is proceeding in a diligent manner to identify the needed water supply and treatment facilities to meet increasing demands. The ability to continue to serve all the District's needs from the western end of the valley without treatment is limited. The District needs a plan to guide the responsible development of additional water supply sources and treatment facilities to meet the demands of their customers. The results of the Groundwater Development and Utilization Feasibility Study were used to identify the sustainable yield of the basin, develop a watershed management plan to protect the resource, site new well locations and prepare a recommended capital improvement program for the District to continue to meet the water supply needs of the valley.

SCOPE OF STUDY

The scope of work for this feasibility study to develop supplemental water supplies included the thorough evaluation of the surface and groundwater resources in Squaw Valley including siting and drilling of new test holes, development of a water resources protection and management

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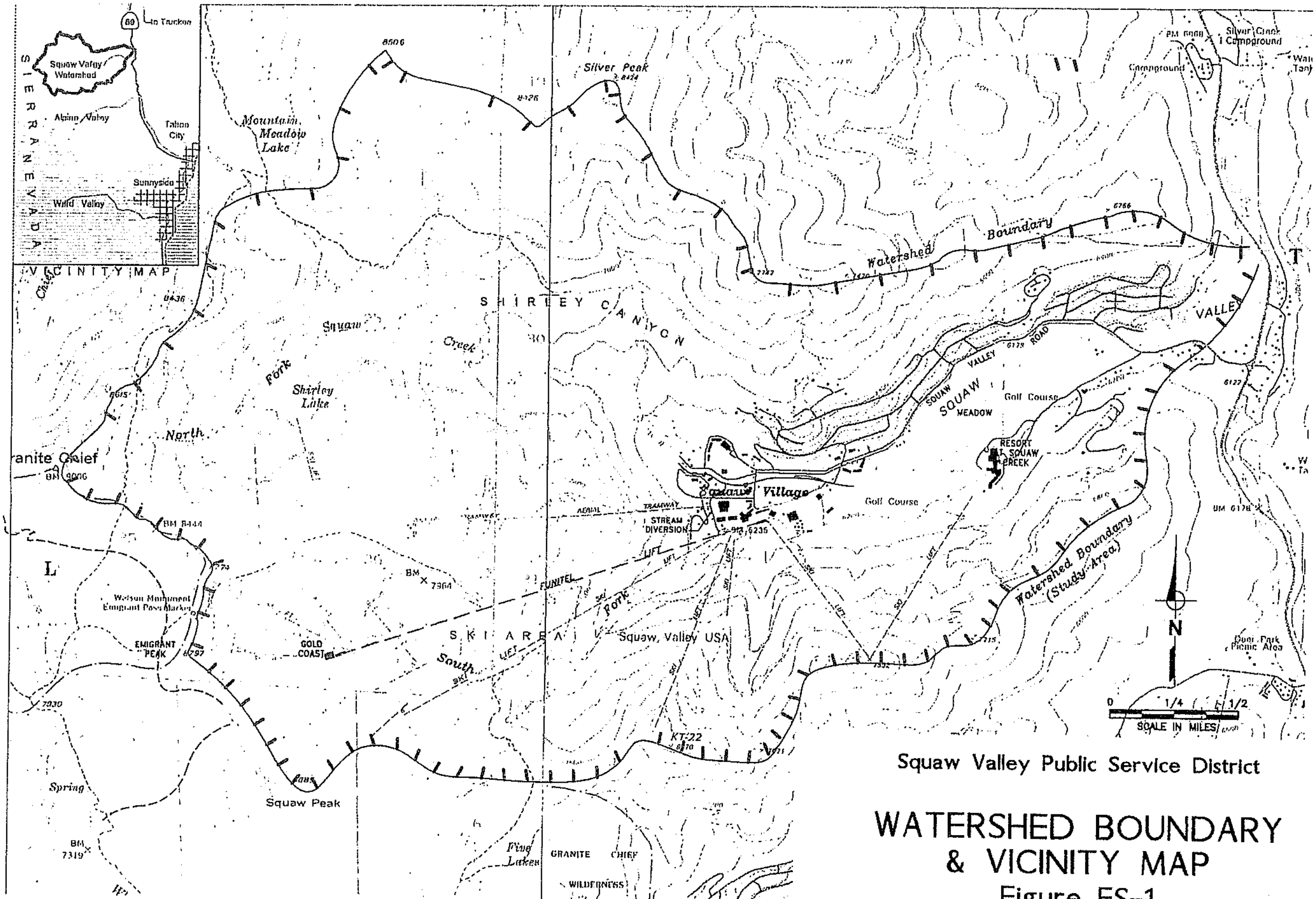


Squaw Valley Public Service District

WATERSHED BOUNDARY & VICINITY MAP

Figure ES-1

plan, development of a basin-wide groundwater model, evaluation of alternatives to meet the District's future water demands, estimation of the basin's sustainable yield, identification of new well sites that can supply water either without and with treatment, and development of capital improvement program recommendations including wells, piping and treatment facilities.

The following sections summarize the work accomplished as part of the feasibility study and present recommendations for the protection, development and use of the water resources in Squaw Valley.

REVIEW AND ANALYSIS OF EXISTING DATA

The initial task in evaluating the available water resources in Squaw Valley was to collect and review available data on the occurrence and use of surface and groundwater in the valley, the physical features and characteristics of the groundwater basin and the numerous petroleum hydrocarbon spills and naturally occurring elements in the valley. The data were used in subsequent tasks including the development of a source water protection plan and watershed sanitary survey, a groundwater hydrology model of the valley, an assessment of the available water resources to meet anticipated demands, and ultimately a recommended capital improvement program to develop additional water supply to meet District's future needs.

Hydrogeologists with Kleinfelder prepared three technical memoranda (TMs) associated with the collection, review, and compilation of background data on the hydrogeology, aquifer characteristics, well construction, and water quality of the groundwater basin in Squaw Valley. The information summarized in these TMs was the primary source of data used in the subsequent tasks performed as a part of this feasibility study. There have been numerous studies, reports, investigations, explorations, and wells constructed in the valley that provide a significant amount of data useful in the development of a computer model of the basin and in analyzing the valley's water resources. During the past forty years numerous wells and borings have been installed and countless water and soil samples collected and analyzed along with pumping tests. These sources provide a large body of data to define the characteristics and occurrence of water bearing strata in the groundwater basin. Review of the published and file material was completed and a synopsis of the pertinent information was summarized by Kleinfelder in a TM entitled "Squaw Valley Groundwater Background Data" dated February 15, 2000. A separate TM, entitled "Report on Field Activities" dated February 15, 2000 was prepared by Kleinfelder on the drilling and sampling of two test holes. This TM described the work performed and summarized the information obtained on the lithology, aquifer characteristics, and water quality. In March 2000, three additional test holes were drilled and sampled by Kleinfelder. Technical data and associated documentation relating to test holes 3, 4 and 5 installed at the Resort at Squaw Creek from March 7 to 11, 2000 were presented in a third technical memorandum dated June 6, 2000.

A separate investigation of known, man-made chemical and natural occurrences of specific elements in groundwater of Squaw Valley was undertaken by Kleinfelder. This investigation identified and evaluated the available information on known chemical contamination sites, primarily releases of petroleum hydrocarbons. The contamination sites were identified from searches and reviewing files from county and state regulatory agencies. Historical photos were also reviewed to assist in identifying the locations of past structures and activities that may have been associated with possible releases of contaminants to the groundwater. A total of 13 petroleum hydrocarbon release sites were identified through this research. The review of the record information on each of these sites was summarized by Kleinfelder in a fourth TM entitled "Known Man-Made Chemicals and Natural Occurrences in Groundwater" dated December 17, 1999.

WATERSHED INVESTIGATION, SOURCE WATER ASSESSMENTS AND GROUNDWATER PROTECTION PLAN

The watershed sanitary survey was conducted to obtain initial information on existing contaminant sources and to identify development and activities in the watershed that may contribute contaminants to surface water and subsequently to the groundwater resources of the valley. Identification of these sources is an important step toward the subsequent development of a watershed management plan to protect the water resources of the valley so that they may continue to serve the vital community needs. The Watershed Sanitary Survey report was submitted to the District for their use in June 2001.

The District and the Mutual Water Company completed Source Water Assessment that included the following elements:

- Delineation of the boundaries of the protection areas for wells providing source water for District customers
- Inventory of the sources of regulated and certain unregulated, contaminants of concern in the delineated areas/capture zones (to the extent practical)
- Determination of the vulnerability of the wells to contamination
- Public education and outreach

The Source Water Assessments Report, finalized in June 2001, also contained the delineation of capture zones for each of the production wells for the 1-, 2- and 5-year periods. The delineated areas or capture zones were determined using the groundwater model developed for the valley as part of this study. The delineated protection areas allow the District to focus protection, management strategies, and resources on areas providing the most benefit to the water resource.

The District invited stakeholders to form the Squaw Valley Groundwater Protection Advisory Group to help identify, develop and implement local measures that will advance the protection of the District's groundwater supply. A series of meetings were then held and a proposed Groundwater Protection Plan prepared.

A groundwater protection plan was developed through the stakeholder process. The plan provides direction and focus for groundwater protection efforts undertaken by the District and the community. The plan outlines management strategies that together will provide the key to a successful prevention program.

GROUNDWATER MODEL DEVELOPMENT

A groundwater flow model of the Squaw Valley Basin was developed as part of this study. Development of the model was discussed in the report titled, "Groundwater Model Report" prepared by Derrik Williams, Registered Geologist. The primary modeling objective was to develop a tool for the District's future water planning efforts that could evaluate future groundwater management alternatives. The model incorporates all known groundwater recharge and discharge mechanisms, as well as all available hydrogeologic data from the basin. The model successfully simulates water level fluctuations in both production wells and monitoring wells throughout the basin, and reasonably simulates flows in Squaw Creek. The combination of a solid technical model base and successful calibration has resulted in a valuable tool for future groundwater management studies.

The groundwater model is the best tool available for estimating effects of various pumping and recharge scenarios, and should be used for planning future groundwater management. Pumping rates from existing wells, placement of future wells, and effects of pumping on stream flows can all be studied with the existing model. The model will improve any future planning decisions, and can identify optimal groundwater management strategies.

As with all groundwater models, additional data will help validate the model, and direct modifications to uncertain model parameters. Data that may be particularly helpful includes measured stream flows entering and leaving Squaw Valley, and additional water level data from the western portion of the basin. Squaw Creek flow data will corroborate estimates of the amount of groundwater lost or gained by stream interaction. Additional stream data will furthermore allow accurate calibration of the impact on streamflow from groundwater pumping.

Water level and hydrologic parameter data from the western end of the Squaw Valley Basin will assist in future water management planning. The western portion of the basin has generally better producing wells, and the groundwater in the western basin generally does not require treatment before it is served. Additional data on the production capability of the western basin, along with information about the impact of Squaw Creek on water levels in the western basin, is crucial to future water planning efforts.

As with all groundwater models, the results are only as accurate as the data on which the model is based. Assumptions about the basin dynamics are based on the best available data at the time of model development. As new data becomes available, new interpretations of the basin hydrogeology may require re-structuring of parts of the model.

ESTIMATE OF ULTIMATE WATER PRODUCTION REQUIREMENT

A projection of the ultimate buildout water demands in Squaw Valley was prepared. Projections are included for the demands served by the District and Mutual, and the Resort at Squaw Creek for golf course irrigation and snow making. The buildout water demand is based on recent estimates by the District of future development that is limited to 80 percent of the development allowed by the 1983 Squaw Valley General Plan and Land Use Ordinance and current water use habits. Estimates of potential water savings from several water conservation measures were also provided. The projection of ultimate water production requirements and a discussion of the need for additional water supply facilities were included.

The buildout water production requirements in the valley with full implementation by the District and the Mutual of the recommended conservation program described above and pumping by the Resort at Squaw Creek for golf course irrigation and snow making is summarized in Table ES-1. The total annual production estimated at full build-out is 2,091 acre-feet per year, or 681 million gallons.

Table ES-1. Required Annual Water Production with Conservation in Squaw Valley at Buildout (af)

Supplier/Use	Required Production
Squaw Valley Public Service District	1,628
Squaw Valley Mutual Water Company	202
Resort at Squaw Creek	
Golf Course Irrigation	138
Snowmaking	123
Total	2,091

Also the average day and maximum day production requirements for the District and the Mutual have been estimated and are shown in Table ES-2. The recommended minimum water supply facilities production capability for municipal water purveyors is to be able to meet the maximum day production requirements with the largest supply source out of service. The maximum day production requirements will be used in future work to identify the needed number and size of wells to be in service at buildout.

Table ES-2. Average Day and Maximum Day Production Requirements for District and Mutual at Buildout

Purveyor	Average Day Production Requirement		Maximum Day Production Requirement[a]	
	gpm	mgd	gpm	mgd
Squaw Valley Public Service District	1,010	1.45	2,525	3.64
Squaw Valley Mutual Water Company	125	0.18	315	0.45
Total Municipal Production Requirement	1,135	1.63	2,840	4.09

[a] Maximum Day Production Requirement = 2.5 times the Average Day Production Requirement

WATER PRODUCTION REQUIREMENTS

The water supply and production for the District and the Mutual are identified in Tables ES-1 and ES-2. The annual supply should be available in all years, except in drought emergency years when demand management should be implemented to reduce demands to equal the supply available. The District has recently enacted a water conservation ordinance to assist in managing the demands and groundwater resource. Section 3.33 "Critical Water Supply Shortage, Emergency Water Conservation Restrictions" of the District's Water Code, sets forth requirements for all District customers to implement mandatory reduction in average base water consumption by 20 percent or more during a critical water supply shortage. A 20 percent reduction in the District's buildout demand shown on Table ES-1 would reduce the annual water supply requirement from 1,628 acre-feet to about 1,300 acre-feet.

The District's water supply production facilities should be capable of supplying the maximum day demand with the largest well out of service. The pumping capacities of the existing wells are shown in Table ES-3. The pumping capacities range from 120 gpm for Well 3 to 400 gpm for Well 5. The District's total pumping capacity is 1,250 gpm. In addition, the District has two horizontal wells that are capable of producing up to 40 gpm. Therefore, the total water supply capacity of all sources is 1,290 gpm. With the largest well out of service, the total capacity is 890 gpm.

Table ES-3. Existing District Water Supply Capacity, (gpm)

Existing Supply Facility	Pumping Capacity
Well 1	390
Well 2	340
Well 3	120
Well 5	400
Horizontal Wells	40
Total Supply Capacity	1,290

In average or wet years, the District's buildout demands were estimated to increase to the values shown in Table ES-2. The water production facilities must produce the maximum day demand with the largest production well out of service. The estimated maximum day demand is 2,525 gpm. Assuming the largest well is out of service, the water supply capacity should be increased by 1,635 gpm. To meet this requirement, the District will need to construct 4 to 6 new wells that produce in the range of 250 to 400 gpm each.

GROUNDWATER MODEL SIMULATIONS TO ESTIMATE SUSTAINABLE YIELD

To develop a reasonable estimate of the dependable water supply that can be developed for use within Squaw Valley, a series of groundwater model runs were completed. The model runs estimated the basin's sustainable yield during drought years. The definition of sustainable yield was first developed and then a series of iterative model runs were undertaken to develop estimates of the maximum pumping that can be sustained during a critically dry year.

Definition Of Sustainable Yield

For this study, sustainable yield has been defined as the maximum amount of water that can be pumped from the groundwater basin during a critically dry year without significantly impacting the pumping water levels of existing wells. The sustainable yield analyses of the basin assumed the recharge in a critically dry year is represented by that experienced in 1994. Pumping of existing wells was increased and proposed new wells added in the basin to identify the maximum annual pumping amount that can be sustained without lowering the pumping water levels below the top of the existing wells' perforations. This criterion is a conservative approach for defining sustainable yield. The District could and has operated its wells at lower water levels for short periods of time. Lowering water levels below the perforations can lead to operational problems including cascading water, entrained air and increased biofouling. A series of analyses were performed to first identify maximum pumping using only the existing District and Mutual wells, and then using the existing wells and proposed new wells, to estimate the sustainable yield of the basin.

Sustainable Yield Analysis

Monthly pumping rates were determined for each simulation and tables created as input data. The model was then run. The resulting water levels in each of the municipal wells were compared to the minimum acceptable water levels. If the levels were found to be above the minimum acceptable elevations for all wells, the pumping rates were increased. Conversely, if the water levels were found to be below the acceptable elevations, the pumping rates were decreased. The sustainable yield was then determined as the maximum annual quantity of pumping that can occur under the critical hydrologic conditions.

Maximum Pumping of Existing Wells

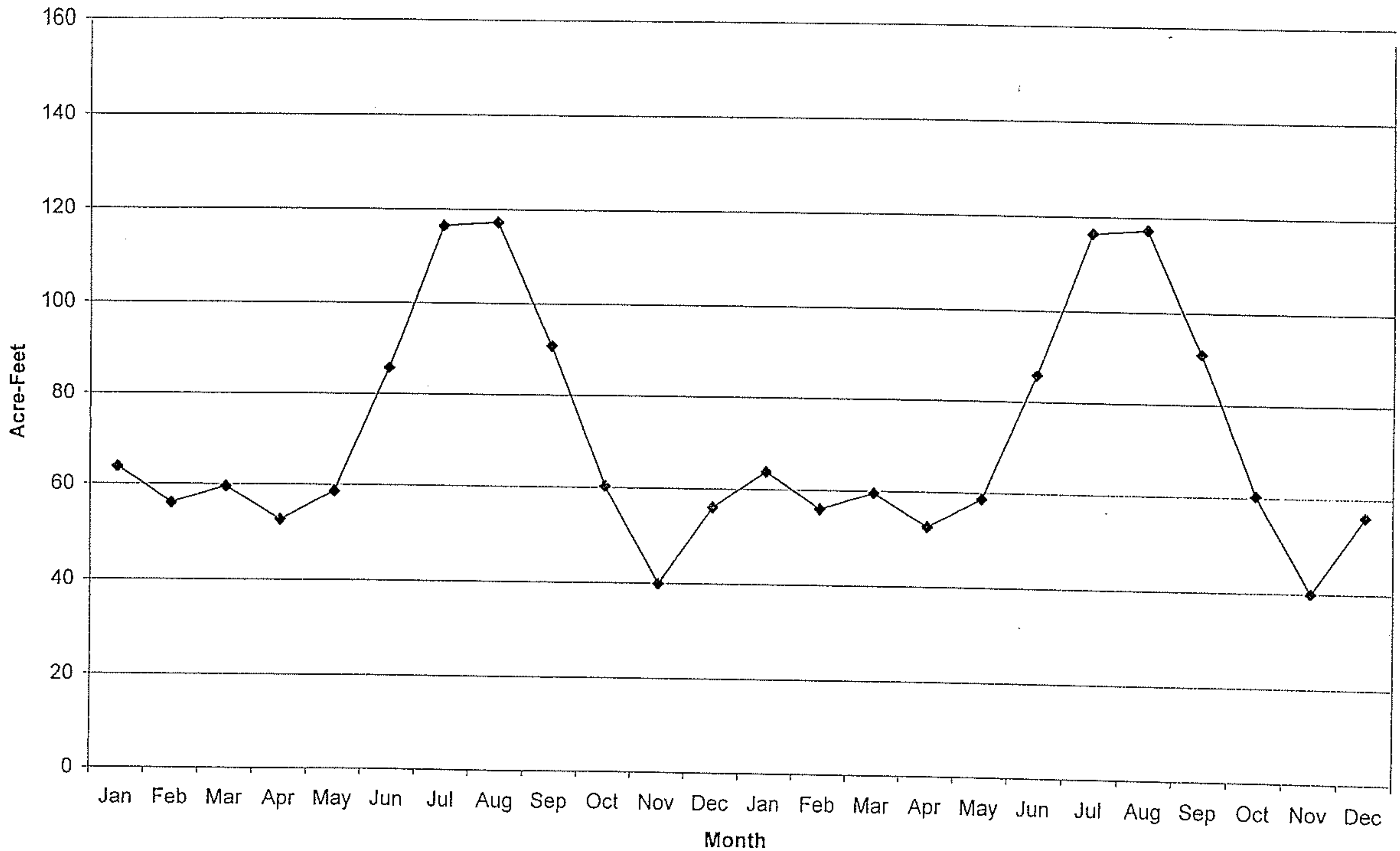
A series of groundwater model simulations were performed to estimate the maximum amount of pumping that could be extracted from existing production wells during a drought year. The drought conditions chosen for the simulations duplicated the dry year conditions of 1994. Each model run simulated two consecutive years of drought. The results suggest that the production wells might be able to sustain the pumping rates shown on Figure ES-2 during a drought, however the drawdown will be extremely close to the maximum allowable drawdown.

The total pumping of existing wells of 858 af/year is a conservative estimate of the sustainable yield in that water levels can be lowered below the top of the perforation for short durations and Wells 2 and 3 could be reconstructed with lower perforations thereby allowing more pumping and lower water levels. This is 319 acre-feet greater than the combined pumping by the District and the Mutual of 539 acre-feet during the year 2000

Maximum Pumping of Existing Wells and New Wells

A series of groundwater model simulations were performed to estimate the basin's sustainable yield, defined at the maximum amount of pumping from the basin during a drought year that maintains acceptable water levels in existing wells. As with the simulations of maximum pumping of existing wells, the critically dry conditions of 1994 were used to represent drought conditions. Each model run simulated two consecutive years of drought.

Figure ES-2. Pumping for District and Mutual Wells at 85% of Base Case Simulation



Monthly pumping rates for the existing production wells were set to the same levels established from the analysis for Maximum Pumping of Existing Wells. Additional wells were then added to the model at locations thought to provide significant water supply, but may be of a quality that requires treatment. Pumping from the Resort at Squaw Creek Wells 18-2 and 18-3 was increased to take advantage of the unused capacity of these wells.

Additional wells that were considered included District Well 4RII, 4th Fairway Well, Test Hole No. 1, and two new wells in the western portion of the basin. No additional wells were added to the area around the existing cluster of wells in the east parking lot area. From previous analyses it appeared that during a drought, no additional water could be extracted from this area.

Analysis of simulations incorporating District Well 4RII showed that during drought years, pumping this well lowers the water level in District Well 2, sometimes significantly. During normal or wet years, this well is fed by recharge from Squaw Creek. Recharge from Squaw Creek is diminished during droughts, however, and this well effectively takes water from District Well 2. District Well 4RII was thus removed from further drought year analyses.

A number of simulations were attempted, using different combinations of wells and pumping rates. The final simulation represents the best conditions, in that it produces the most water, while resulting in the least additional drawdown in existing wells. The final pumping rates shown in Figure ES-3 represent approximately 80 percent of the buildout demand identified in Table ES-1, which represents about 65 percent of the demand if full buildout of the 1983 General Plan and Land Use Ordinance were permitted.

Figure ES-4 shows the water levels (one foot contours) in August for the first simulated drought year. All the pumping wells including the Resort's Wells 18-1, 18-2, 18-3 and the two new wells at the western end of the basin is shown on Figure ES-4. This figure shows a large amount of drawdown at 18-3, but relatively minor drawdown at the two new wells.

The simulations suggest that it will be difficult for the District to meet the estimated buildout demands during critically dry years. This is primarily because of the lack of summertime recharge from Squaw Creek during drought years. Groundwater model simulations suggest that approximately 80 percent of the buildout demand can be supplied by groundwater during a critically dry year. This is equivalent to an annual sustainable supply of 1,637 acre-feet per year. These results assume a well efficiency of 70 percent; lower well efficiencies may result in less available supply. Of this total sustainable yield, pumping by each valley entity based on the assumptions in the simulations is shown in Table ES-4.

Table ES-4. Sustainable Yield Analysis – Assumed Pumping Rates, (acre feet)

Pumping Entity	Annual Pumping Amount
Squaw Valley Public Service District	1,204
Squaw Valley Mutual Water Company	172
Resort at Squaw Creek	261
Total Sustainable Yield	1,637

Figure ES-3. Monthly Pumping Rate for Most Acceptable Buildout Simulation

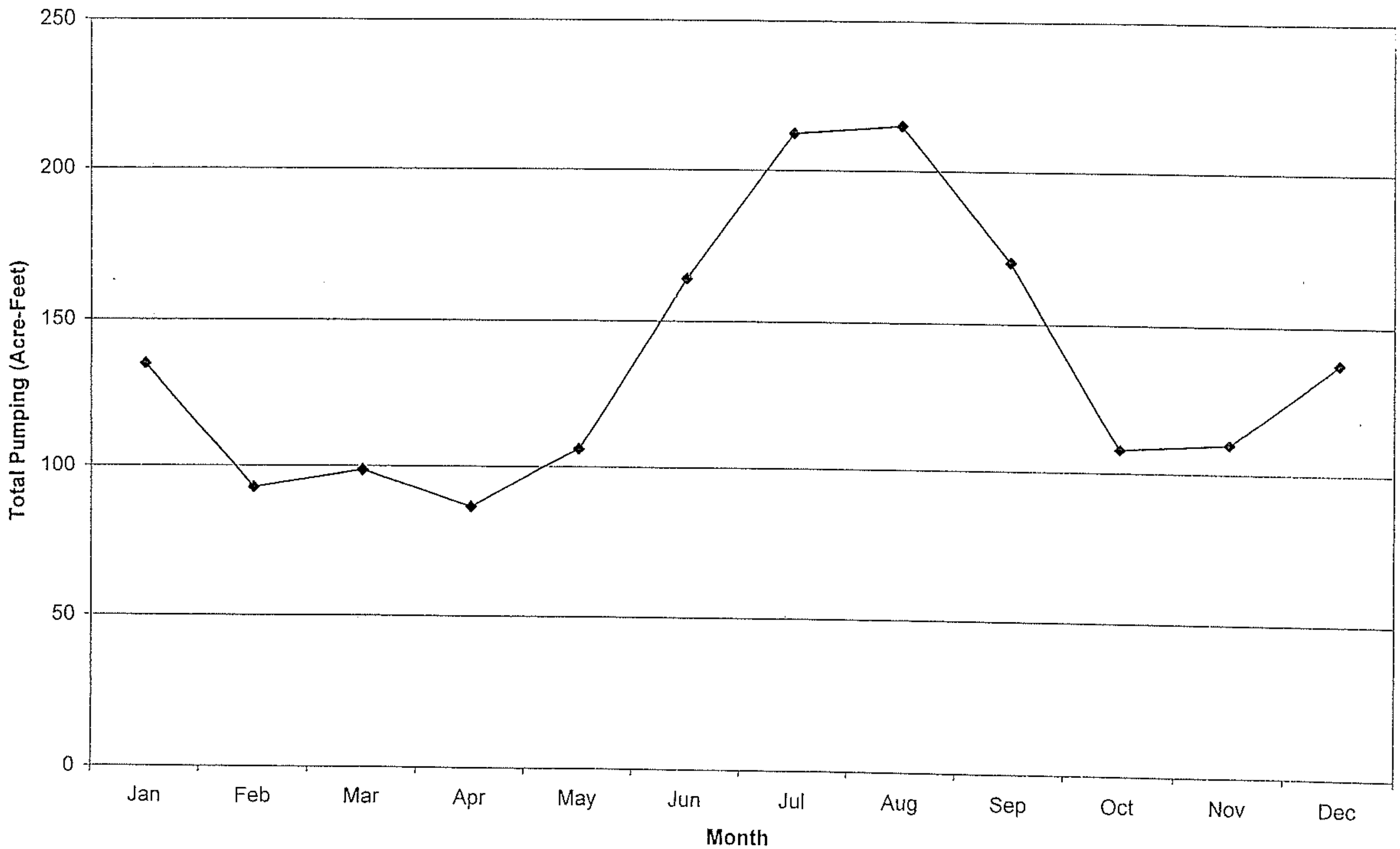
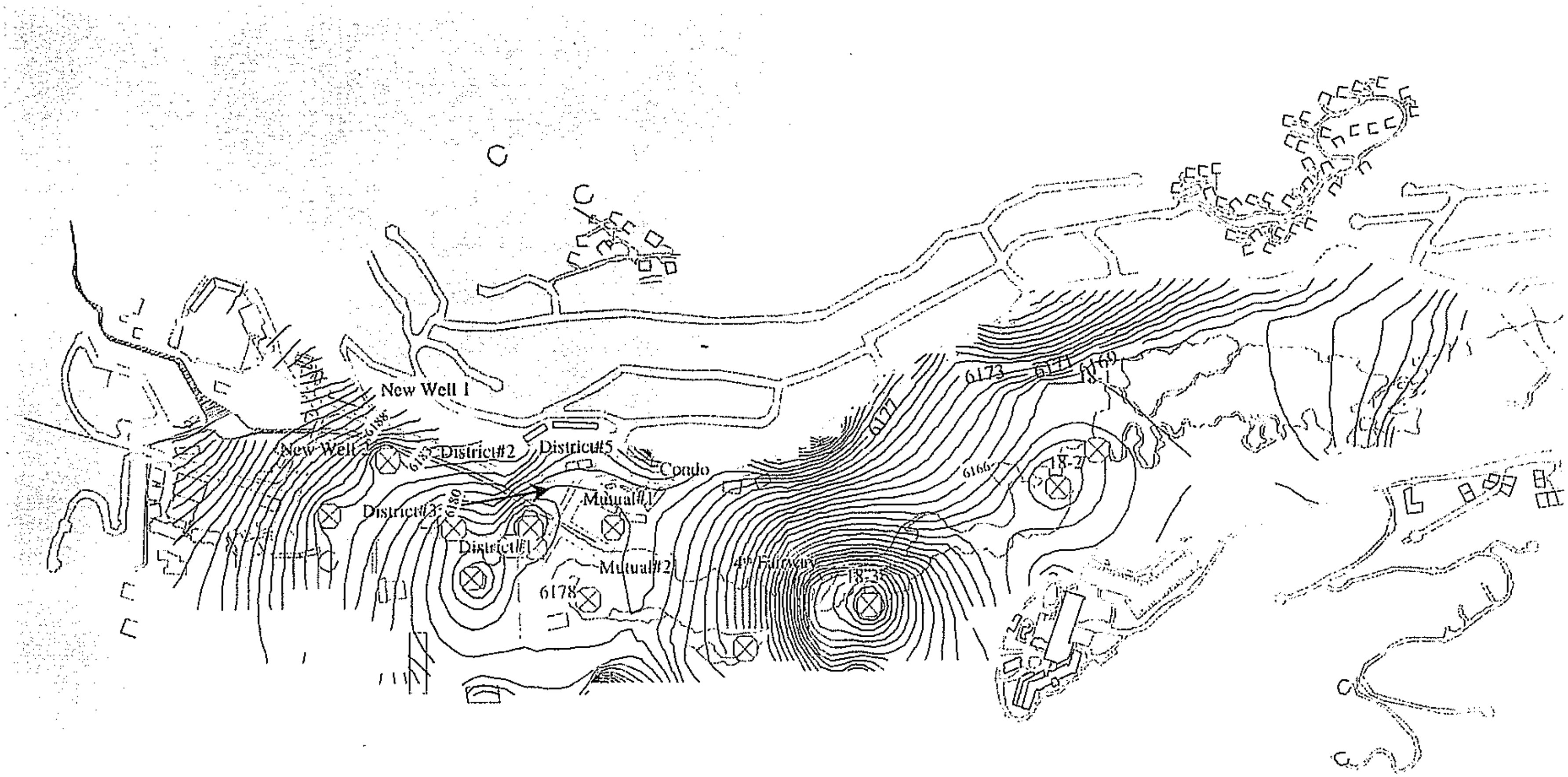


Figure ES-4
Sustainable Yield Analysis Maximum Pumping Simulation
August Water Level Contours



ALTERNATIVE WATER SUPPLIES EVALUATION

The District's estimated annual demand at buildout is 1,605 acre-feet (af). The sustainable yield of the groundwater basin was estimated to be about 1,640 af per year. The District's portion of the sustainable yield has been assumed to be about 1,200 af as was shown in Table ES-4. The District's horizontal wells in an average year produce about 30 to 45 af. They will probably produce about half that amount during a drought year. Therefore, the total supply available to the District is about 1,220 af. A supply of 1,220 af will provide about 76 percent of the District's buildout demand during a critically dry year. The remainder must be supplied from other sources, or the demand during a critically dry year be reduced by about 24 percent through conservation or by limiting development. The supplemental production capacity required to meet District maximum day demands at buildout is about 1,600 gallons per minute.

The District has recently passed a water conservation ordinance that includes the curtailment of demands during a critically dry year. The ordinance requires that normal demands be reduced by at least 20 percent during a drought emergency. Demand management should be part of the final solution for meeting future demands in the valley.

Facilities must be identified to supply both the projected annual and maximum day demands. The alternative water supplies using sources inside the valley and outside the valley identified and evaluated as part of this study were:

- Additional Squaw Valley Wells
- Springs East of the Truckee River
- Truckee River Wells
- Alpine Springs County Water District

Each of these alternative supplies have been investigated and evaluated in terms of their feasibility of meeting some if not all of the increased water supply needs.

Additional Squaw Valley Wells

Four to six wells located within Squaw Valley are required to supplement the production from existing wells to meet projected maximum day demands at buildout. It is assumed that each well will have a production capacity of between 100 to 400 gallons per minute (gpm).

The pumping capacity from the wells that will continue to be considered as elements of the Squaw Valley Groundwater Alternative are summarized in Table ES-5. Their total pumping capacity is 1,600 gpm, which equals the amount of additional supply required at buildout. It has been shown in the sustainable yield analysis that these wells in combination with the existing District wells can produce the sustainable yield of the basin without adversely impacting water levels.

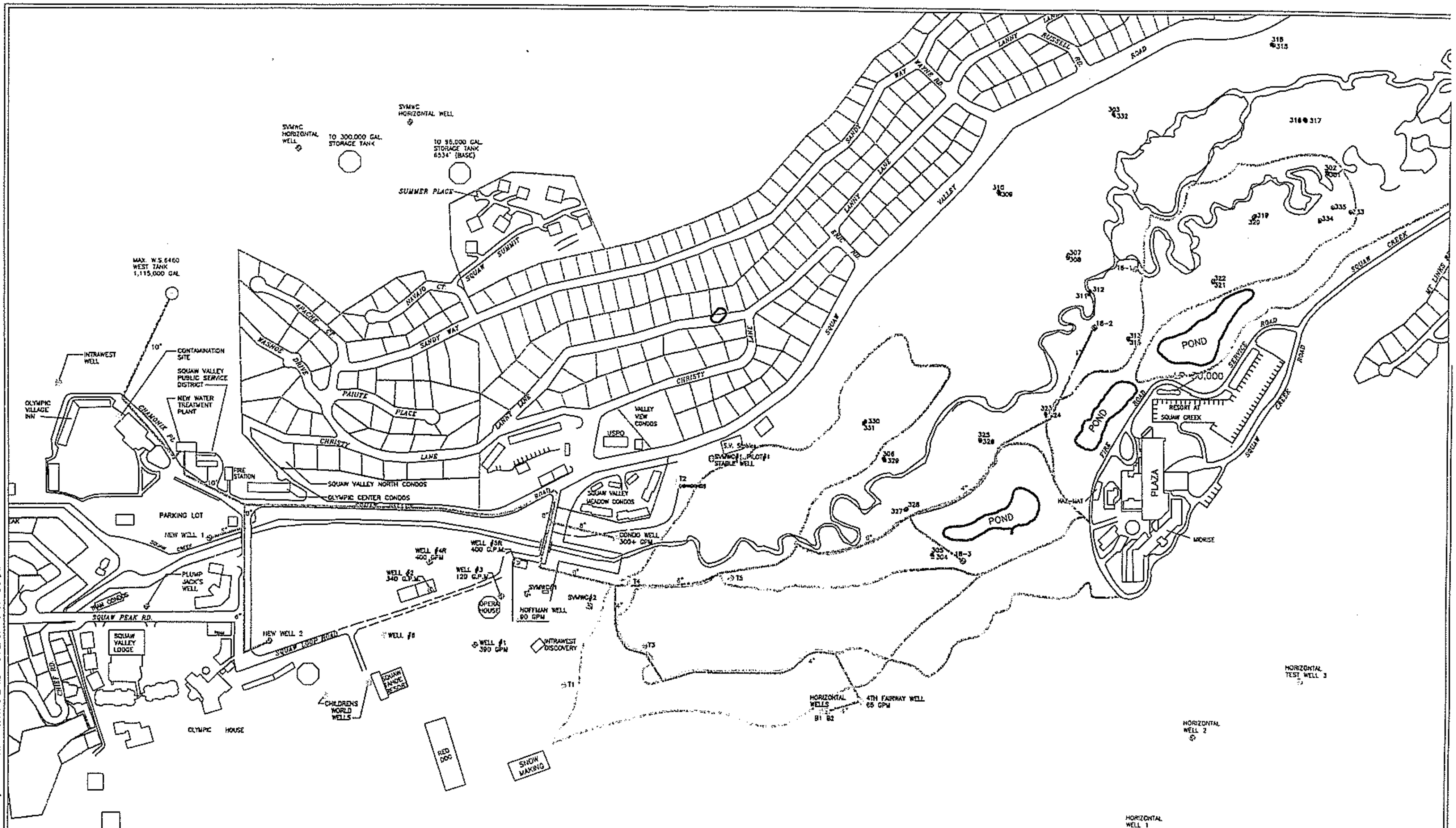
Table ES-5. Wells Included in Squaw Valley Groundwater Supply Alternative

Well Name	Assumed Pumping Capacity, gpm	Treatment Required
Well 4R II	400	No
Condo	300	Yes
4th Fairway Well	100	Yes
New Well 1	300	Yes
New Well 2	300	Yes
Wells 18-2 and 18-3	200	Yes
Total Pumping Capacity	1,600	

Wells to be included in the Squaw Valley Groundwater Supply Alternative are shown on Figure ES-5. The water from all the new wells, except Well 4R II, must be treated to remove iron and manganese. It is assumed that supply from the horizontal wells located near the 4th Fairway well will be incorporated into pipe systems to bring the supply to the treatment plant. Pipelines to deliver water to the proposed treatment plant are also shown on Figure ES-5. An iron and manganese removal treatment plant has been evaluated and the preferred site for the plant based on a study performed by the District is at the existing District office site, just behind the existing office building. Section 8 provides the details of the evaluation and recommendations on the proposed treatment plant. The treatment plant would have a nominal capacity of 1,400 gpm or 2 mgd.

Springs East Of The Truckee River

A local supply could be developed using the springs located about 4,500 feet southeast of the intersection of Squaw Valley Road and Highway 89. It was found that there is limited recharge in this area because of the impaired vertical permeability within the overlying volcanic rock. In addition, TCPUD used the area above the springs for many years to dispose of their primary treated wastewater effluent. DOHS has reviewed the use of this supply and has serious concerns about the water quality from these springs. District staff have recently visited the old spring collection boxes and found them to be in disrepair and producing a very low flow. It did not appear that these springs would provide a significant supply of water to the District, and their ability to be permitted by the DOHS without treatment is unlikely. This supply alternative has been dropped from further consideration for these reasons.



LEGEND
- PRODUCTION WELL
- TEST WELL
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- APPROXIMATE GOLF CART PATH
- NEW PIPELINE

NOTE: WELL LOCATIONS ARE APPROXIMATE
MAP SOURCE: SQUAW VALLEY PUBLIC SERVICE DISTRICT, 1999 WITH WELL LOCATIONS PROVIDED BY KLEINFELDER

Figure ES-5

Squaw Valley Public Service District
GROUNDWATER SUPPLY ALTERNATIVES

WEST YOST & ASSOCIATES

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Truckee River Wells

The District may be able to divert surface water from the Truckee River. The Truckee-Carson-Pyramid Lake Water Rights Settlement Act of 1990, Public Law 101-618, includes the settlement of water rights claims on the Truckee River between the State of California, the State of Nevada and the Fallon Paiute-Shoshone Indian Tribe. However, in drought conditions spanning several years, releases from Lake Tahoe could be eliminated in the summer when the lake level drops below the natural rim elevation. Hydrologic studies for the Truckee River Operating Agreement (TROA) show that surface water could be available for diversion by the District during over 90 percent of the time. Diversion of water during droughts that are sustained for several years, such as the 1988 to 1992 drought, would probably be curtailed. Use of this source of supply would have to be coordinated with other water rights holders during extended dry periods to provide any supply to Squaw Valley. Therefore, consideration of this alternative as a firm water supply to sustain additional development was eliminated.

Alpine Springs County Water District

Alpine Springs County Water District (ASCWD) is located about 1.5 miles south of Squaw Valley. ASCWD's water supply facilities include four springs, two wells, and two snow production wells within the Bear Creek Valley. The combined capacity of the springs and wells is estimated to be about 1,100 gallons per minute according to a 1998 Water Audit prepared by ECO:LOGIC Engineering with all facilities operating. The actual capacity varies slightly between summer and winter conditions. The maximum day summer water demand of ASCWD is estimated to be about 400 gallons per minute, leaving as much as 700 gallons per minute of possible idle supply capacity. However, it is not known at this time how much water would be available from ASCWD during any given year. The snow making wells are not used in the summer months, but the long-term sustainable yield from the wells, constructed in fractured rock has not been proven. Therefore, consideration of this alternative as a firm water supply to sustain additional development was eliminated.

The only alternative that provides the needed maximum day demand production and has a significant sustainable annual yield is the addition of new wells and an iron and manganese treatment plant in Squaw Valley. The Squaw Valley Wells alternative cannot provide sufficient supply to meet full buildout demands, without implementation of demand reduction measures. However, this alternative, coupled with a 20 percent reduction in demands, could meet the District's supply needs in a critically dry year.

WATER TREATMENT PLANT ALTERNATIVES

The groundwater quality data obtained from sampling production and test wells in Squaw Valley was reviewed to determine the general water quality characteristics of various groundwater sources, and establish specific treatment requirements to remove contaminants of concern. This evaluation was a preparatory step to identify the alternative treatment process that meets the goals of the study. The goal is to identify those treatment processes that can provide water that meets or exceeds current drinking water standards, provides flexibility for expansion and future treatment needs, and is cost effective. The recommended processes were further defined and conceptual treatment plant layouts and cost estimates prepared and the recommended treatment alternative was identified.

Treatment Process Evaluation

The favored treatment processes for removing iron, manganese and perhaps arsenic from the groundwater have been reviewed. A preliminary screening of potential processes was completed prior to identifying the favored processes. The capability of meeting treated water quality objectives applicable to water quality conditions in the valley were the major factor leading to the selection of viable treatment processes. The three process alternatives considered were:

1. Pressure greensand filtration
2. Ozone oxidation/gravity filtration
3. Membrane filtration

Pressure Greensand Filtration combined w/ UV Sterilization

The conventional method for removal of iron and manganese from groundwater involves oxidation, generally with chlorine, chlorine dioxide, potassium permanganate or perhaps ozone, followed by filtration. Pressure filters are generally used in iron and manganese filtration applications. Often where both iron and manganese are present at concentrations above the MCL, the manganese greensand filtration process has certain advantages that make it an attractive process. Consequently, in the ensuing cost analyses, the conceptual design was based upon the use of the manganese greensand filtration process. Costs received from a vendor of iron and manganese filtration treatment systems were used for the greensand pressure filtration alternative.

The greensand filtration process, although generally used where iron and manganese is the principal concern, also has the ability to perform effectively as a filtration media for arsenic removal. The pressurized greensand filtration process could be used for arsenic removal wherein oxidation of the reduced forms of arsenic generally found in groundwater would be accomplished with chlorine and potassium permanganate or perhaps ozone, and then removed through filtration. To improve arsenic removal, a small amount of a primary coagulant such as aluminum sulphate (alum) or ferric chloride could be added to remove the arsenate precipitate.

The inline filtration process (pressure greensand filters) has some limitations when used for removal of microbial contaminants of surface water origin. For example, the DOHS discourages the use of pressure filters using the inline filtration process for surface water sources because of concern for turbidity breakthrough caused by the generally higher pressure used with pressure filters. Where the inline process is used, however, DOHS restricts the pressure filter rates to no more than three gpm per square foot of filter area. Recognizing that there is a possibility that new wells may possibly fall under the influence of surface water contamination, a filtration rate of 3 gpm per square foot was selected to size the pressure filters for this principally iron and manganese removal application. If a surface water source becomes available in the future, a filtration rate of 3 gpm per square foot would also comply with the current design standard for the use of pressure filters for surface water treatment. It is likely, however, that for a direct surface water treatment application, or in a situation where groundwater wells could become contaminated with surface water inflow, an additional treatment barrier would be needed to comply with DOHS standards.

A process such as ultraviolet (UV) sterilization could be applied to the filtered water to meet possible cryptosporidia removal standards requiring a higher level of disinfection than could be provided solely by chlorination. Ultraviolet light sterilization has been found to be very effective for inactivation of cryptosporidia oocysts. UV treatment would probably also be the most effective and least expensive addition to the pressure filtration process to meet drinking water standards. Consequently, space should be provided in the treatment facilities for the addition of an ultraviolet disinfection process should it become necessary in the future.

Ozone Oxidation/Gravity Filtration

A treatment process alternative using ozone and gravity filtration was considered because this process would have the capability of oxidizing and removing iron and manganese, and inactivating and removing any microbial contaminant of surface water origin. Further, this complete treatment process, supplemented with ozone, would also be able to effectively treat any quality surface water supply while meeting all current and anticipated future drinking water standards. The ozone/gravity filtration process is significantly more complex than the pressure filtration alternative, but would have substantially greater treatment capability. The process could very adequately treat all groundwater sources in the basin, and effectively remove iron, manganese, and arsenic. Consequently, a process alternative based upon the ozone/gravity filtration alternative furnished in a factory-built package plant by U.S. Filter (Trizone process) was considered in the evaluation.

Membrane Filtration

A preliminary assessment of the feasibility of using membrane filtration for this application was also completed. Discussions with membrane suppliers indicated that iron and manganese would have to be first oxidized with a combination of chlorine and potassium permanganate prior to membrane filtration. The membrane process, thus offers no advantages with respect to possible elimination of chemical treatment requirements.

Following this preliminary screening, the first two process alternatives were retained, and the membrane process was eliminated from further analysis. Conceptual designs were then developed for the pressure greensand and the ozone oxidation/gravity filtration process. The principal components of each system alternative were identified and preliminary design criteria developed for the processes. These criteria and the conceptual design information were then used to prepare projected construction costs for a treatment facility designed around one of these two treatment processes.

Treatment Process Recommendation

Evaluation of the two most appropriate treatment process alternatives indicates that a treatment facility designed around the pressure greensand filtration process for iron and manganese removal would be the preferred alternative. It appears that the treatment requirement is primarily for iron and manganese removal and pressure filtration is substantially less costly than the other alternatives. This treatment process can also remove arsenic should levels in the groundwater rise above the MCL. Only if a surface source becomes available would the ozone/gravity filtration modular treatment alternative process be more suitable than the recommended process. However, the pressure greensand filtration system can be upgraded with UV treatment of the filtered water permitting DOHS to approve the use of the process for treating a surface source or a groundwater under the influence of a surface source. The estimated cost to add UV sterilization to the pressure greensand filtration treatment system would probably be about $350,000. Space has been provided in the conceptual facility layout to accommodate future UV disinfection equipment. Operation and maintenance costs favor this alternative over the ozone/gravity filtration alternative by a wide margin.

RECOMMENDED WATER SUPPLY AND TREATMENT FACILITIES

As stated previously, the District is expected to need an additional 1,600 gpm in water production capacity to meet buildout water demands. The annual water consumption at buildout is estimated to be 1,605 af. The Squaw Valley Groundwater Supply Alternative provides the needed production capacity to supplement the existing wells to result in sufficient supply capacity to meet the maximum day demand at buildout with the largest producer out of service. The groundwater basin has been shown to have a sustainable yield of about 1,640 af with the District's shared amount of it being 1,200 af. The groundwater supply alternative develops the full sustainable yield of the basin. To meet build out demands, additional supply from outside the valley would be needed. The Squaw Valley groundwater supply will be adequate if the future development is limited or the District's conservation ordinance is enforced in critically dry years to reduce demands by 24 percent. It is anticipated that five new wells will be constructed to provide the needed production capacity. In addition it is assumed that the idle capacity of the Resort Wells 18-2 and 18-3 can be made available to the District. The recommended facilities are shown on Figure ES-5. This recommended plan is to be used as a guide and can only be implemented if well sites can be acquired and the expected production is developed.

A supply connection with Alpine Springs County Water District (ASCWD) is recommended at the time the Homesites at Squaw Creek #2 subdivision is constructed. The intertie with ASCWD could be used under emergency conditions or provide water to the District on a regular basis if idle supply capacity is available and an agreement can be negotiated between the districts. The sizing of the intertie pipeline would be determined at the time the subdivision project moves ahead and the amount of water available from ASCWD is known.

Is this still option w/ Fish issue.

It is also recommended that a water rights application be filed immediately for a surface water diversion from the Truckee River. This would establish a placeholder for this supply so the District will have some flexibility in the future should conditions change. Additional investigations should be performed to determine how the reliability of the supply could be enhanced to provide benefit to Squaw Valley during drought years. The treatment plant can easily be retrofitted with UV disinfection equipment to be able to treat this supply.

The recommended treatment plant is a pressure greensand filtration system located in a new building in back of the existing district office complex. The plant is envisioned to have a buildout capacity of 2 mgd, with the building sized to accommodate treatment facilities capable of treating up to 4 mgd. This will provide assurances of being able to build a 4-mgd treatment plant if the need arises to treat more of the groundwater supply or a surface water source. The 2 mgd treatment plant is comprised of two pressure filters with a treatment capacity of 1 mgd each.

This configuration lends itself to phasing the facility by installing one filter first and waiting until demands increase before installing the second filter and associated equipment.

Recommended Improvements

The recommended facilities to be constructed to meet buildout demands are shown on Figure ES-5. The facilities and estimated capital cost are shown on Table ES-6. These costs do not include the cost of the land for the wells or the cost for pipeline easements not in public rights-of-way. These costs, when they are identified, will need to be added to the costs shown in Table ES-6.

Table ES-6. Recommended Water Supply Facilities and Estimated Capital Costs (1)

Item	Unit Cost, Dollars	Estimated Cost, Dollars
2 mgd Water Treatment Plant for Iron and Manganese Removal	Lump Sum	2,875,000
5 New Wells	425,000	2,125,000
3,300 feet of 4" pipe	40	132,000
3,900 feet of 6" pipe	60	234,000
2,100 feet of 8" pipe	80	168,000
1,700 feet of 10" pipe	100	170,000
Total Construction Cost		5,704,000
Engineering, Legal, & Admin Costs @ 20%		1,141,000
Total Project Cost		6,845,000

(1) Costs are in 2001 dollars

Phasing Of Improvements

The facilities included in the recommended supply plan can be phased as demands increase. The initial facility that should be constructed is the drilling of the replacement well for Well 4R. Wells at this location have proven to be good producers with good water quality that does not need treatment. It is expected that this well will be similar to Well 5R in terms of production and will provide the District with additional pumping capacity and reliability in meeting peak demand periods with the largest producer out of service. Should it be found that Well 4RII produces groundwater under the influence of surface water, it can be connected to the treatment plant for treatment and disinfection; however, UV disinfection equipment would need to be added at the treatment facility.

The next activities to be undertaken include further exploration and testing of potential well sites to identify the next set of wells to be added to the system. Test Wells 4 and 5 should be test pumped to identify the source of poor water quality. Water bearing strata should be isolated and water quality samples obtained. The results of the pump testing and water quality testing should identify the feasibility of developing production wells at these locations of suitable quality for domestic purposes.

The potential for the use of the Resort at Squaw Creek Wells 18-2 and 18-3 should be investigated. The wells should be retrofitted with level monitoring equipment and the pumping amounts and drawdown should be monitored to ascertain the production capabilities and potential for use as a year-round supply for the District.

A study should be performed to identify the improvements that would be necessary to include the production from the horizontal wells near the 4th Fairway Well into the supply system. The horizontal wells' production could be pumped into the existing distribution system pipeline that serves the Resort or added to the production from the 4th Fairway Well delivered to the water treatment plant.

The treatment plant can be phased to provide just 1 mgd (700 gpm) of capacity with room in the building to provide another pressure filter later. The cost savings for phasing the treatment would only be about $500,000, which is the cost of a pressure filter; associated piping and chemical feed system. At least two additional wells will need to be added to provide the 700 gpm of production capacity, although, the treatment plant could begin operation with only one well. The most likely wells to pursue initially are the Condo Well and the 4th Fairway Well. The Condo Well was drilled in 1992 and will require some cleanup and development work before a pump and motor can be installed. The 4th Fairway Well will need to be redrilled using a larger casing.

In addition to these wells, the connections to the Resort Wells 18-2 and 18-3 should be made. The District will need to develop an agreement with the Resort at Squaw Creek for the use of the idle well production capacity and an easement for the pipelines to deliver the water to the eastern edge of the parking lot near Well 5R. The rest of the pipeline easements will also need to be acquired to connect the pipeline to the public rights-of-way along Squaw Valley Road. The combination of the two new wells and the idle capacity of the Resort wells will provide at least 700 gpm of pumping capacity to the first phase of the treatment plant. A total of 8,500 feet of the 4-inch to 10-inch pipelines shown on Figure ES-6 will also need to be constructed in the initial phase.

The treatment plant would be expanded when demands increased and the two new wells in the western parking lot are needed. The piping and much of the ancillary support structure for the new pressure filter will have been constructed as part of the initial phase of the treatment plant project. The wells will need to be sited, test drilled and the property acquired prior to the construction of the wells. The 1,300 feet of 6-inch and 8-inch pipelines connecting the wells to the treatment plant will also need to be constructed.

The recommended plan provides the District with flexibility for developing the needed supplemental water supply in terms of the number and location of wells required to meet future demands. The identified locations are based on previously drilled test holes. If other sites are found to be better well locations and can be developed to produce 300 to 400 gpm while maintaining or increasing the basin's sustainable yield, then they can substitute for the any of the wells. Having a pipeline through the golf course provides opportunities to develop wells along that route if reasonable water quality and production can be developed. Supply from additional horizontal wells along the valley's south side or drilled wells in the east end of the valley could be delivered to the treatment plant via the golf course pipeline. The area between the Resort at Squaw Creek and the existing well field area has been identified as the most promising target area for future successful production wells.

GROUNDWATER MANAGEMENT PLAN

Groundwater is a precious resource in Squaw Valley that is and will continue to be relied upon as the water supply for the valley. The objective in developing a groundwater management plan is to provide a long-term strategy for sustainable groundwater basin use for all entities relying on this water supply. Development and implementation of the recommended groundwater management plan will allow the District to effectively manage the basin with respect to the quantity and the quality of the water pumped. The goals of the plan are to keep the pumped amounts within the sustainable yield of the basin and protect the wells from potential contamination.

The groundwater model developed for this project provides the District with a tool for making management decisions on the use of the groundwater resource in Squaw Valley. It has been shown to reasonably simulate the geohydrology of the basin. It is the best tool available for estimating the effects of various pumping and recharge scenarios, and should be used for planning future groundwater basin management. Pumping rates from existing wells, placement of new wells, and effects of pumping on streamflow can all be studied with the existing model The use of the model will improve any future planning studies.

As with all groundwater models, additional data will help validate the results and direct modifications to uncertain model parameters. Data that will be particularly helpful include measured streamflow entering and leaving the basin and additional water level data from or near the pumping wells. The collection of this data will allow more accurate calibration of the basin model, particularly in terms of the annual water balance.

The definition of sustainable yield is the maximum amount of pumping that can be pumped from the groundwater basin during a critically dry year without significantly impacting water levels in existing wells. The definition of significant impact to existing wells is not lowering the pumping levels to below the top of the perforations. A pumping scenario has been identified that maximizes monthly pumping of existing wells without lowering the pumping levels below the top of the perforations. This monthly pumping pattern should be used by the District as a guide for managing the pumping from the groundwater basin.

The water levels in each well should be monitored and pumping adjusted so levels remain above the top of the perforations. During dry years, the need for increased water conservation measures should be coordinated with ongoing review of precipitation, stream flow and pumping levels and amounts. The District has recently enacted a water conservation ordinance that calls for restrictions on the use of water in the event of any threatened or existing water shortage. The ordinance also provides for the implementation of a mandatory reduction in demands by 20 percent or more during a critical water supply shortage. In any year that experiences precipitation that is below normal amounts, the District should review the condition of the groundwater basin and the need for increased water conservation. The results of this study have shown that the water supply in Squaw Valley is a limited resource. The initiation of water use restrictions should be considered in the fall of each year that the groundwater levels are at or below the top of the perforations in Well No. 2. The use of groundwater for snowmaking should also be critically reviewed if the groundwater levels have not substantially recovered prior to the onset of the ski season. The model is currently being updated with the current year's hydrology and expected pumping amounts to assist in managing the basin this summer. This year has had the least amount of precipitation ever recorded at the Squaw Valley Fire Station in its 37 years of record. Decisions will be made on managing the groundwater resource after the model results are reviewed.

A program to obtain additional information for the model and to manage the basin has been identified. The program includes monitoring water levels of all pumping wells, establishing stream gages on Squaw Creek and providing groundwater protection by abandoning unneeded existing wells and establishing a monitoring network in the western basin. The benefits to the District and Mutual Water Company from a more complete monitoring program include the establishment of an early warning system in case of groundwater contamination from spills in the production well capture zone, and to obtain more information for the refinement of the groundwater model. The monitoring network in the western basin would include real-time water level monitoring in all production wells and a ring of monitoring wells upstream of the production wells where water quality samples could be collected and tested quarterly to identify the presence/absence of contaminants that may have entered the groundwater. The early warning monitoring and testing will give the District and Mutual time to react to the contamination and maintain adequate water supplies with wholesome quality for their customers. The information obtained from the monitoring program will also be useful in updating and improving the groundwater model with more complete information on groundwater levels in response to pumping and stream flows entering and leaving the valley. An updated model would provide additional confidence in using the model for making decisions on management of the basin and to verify and refine the estimate of sustainable yield of the resource. The recommended activities to be undertaken as part of the groundwater management plan are listed below.

1. Identify, locate and map test wells and monitoring wells in the western end of valley.
2. Determine which wells may be used for monitoring and which need to be abandoned.
3. Complete the well SCADA system to monitor pumping and level at all wells. Expand system to other pumping wells in valley, if possible.
4. Properly abandon all unnecessary wells and equip others for monitoring levels or periodic sampling to identify possible contamination plume movement.
5. Identify other locations for additional monitoring wells, construct wells and install monitoring equipment.
6. Install three stream gages within Squaw Creek; one on each major branch entering the west end of the valley and one at the upstream side of the Squaw Valley Road bridge.
7. Establish an ongoing monitoring program for the collection of surface water and groundwater data and to monitor quality of water in the production wells capture zone. Update the groundwater model when sufficient data has been collected.
8. Prepare a groundwater management report consistent with the requirements of AB 3030 and submit it to the State Department of Water Resources. Apply for grant funds to support ongoing groundwater management program activities.
9. Develop public outreach and education program as described in the Groundwater Protection Plan in Section 3.

The cost of the above-described activities is estimated to be about $250,000. The implementation of the groundwater management plan will directly benefit all users of the Squaw Valley groundwater basin. While the District and Mutual are not required to develop a groundwater management plan as defined by AB 3030, the State's groundwater management planning legislation, the implementation of a plan provides a definitive program for the collection and use of monitoring data to help ensure the maintenance of the quality and quantity of the local groundwater resource. With this program, informed decisions in managing the available groundwater can be made to assure an available supply in the future.

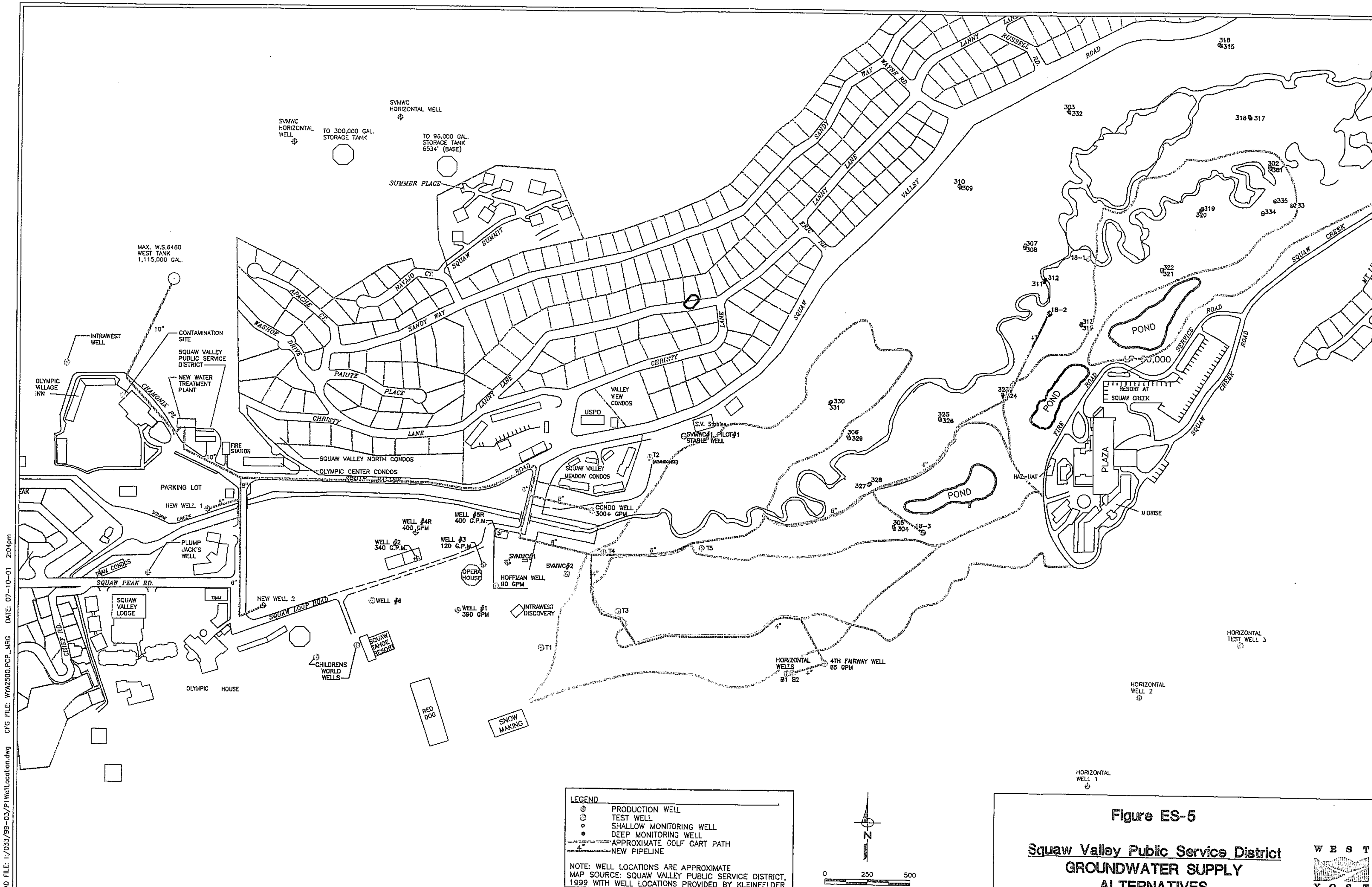

Figure ES-5

Squaw Valley Public Service District
GROUNDWATER SUPPLY ALTERNATIVES

CAD FILE: I:/033/99-03/P1WellLocation.dwg CFG FILE: WYA2500.PCP_MRG DATE: 07-10-01 2:04pm

REVISED RESULTS OF
AQUIFER TESTING AND IMPACT ANALYS!
PLUMPJACK IRRIGATION WELL
OLYMPIC VALLEY, CALIFORNIA

KLEINFELDER

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REVISED RESULTS OF AQUIFER TESTING AND IMPACT ANALYSIS PLUMPJACK IRRIGATION WELL OLYMPIC VALLEY, CALIFORNIA

September 19, 2003

KLEINFELDER
An employee owned company

September 19, 2003
File: 22705.01-R

Mr. Rob Goldberg
Plumpjack Squaw Valley Inn
P.O. Box 2402
1920 Squaw Valley Road
Olympic Valley, California 96146

SUBJECT: **Revised Results of Aquifer Testing and Impact Analysis**
Plumpjack Irrigation Well
Olympic Valley, California

REFERENCE: *Plumpjack Squaw Valley Aquifer Test Simulation, by Derrik Williams, dated September 12, 2003.*

Dear Rob:

In accordance with our proposal dated October 8, 2002, Kleinfelder is pleased to present the results of aquifer testing and impact analysis for the Plumpjack Irrigation Well (IW).

- The Plumpjack IW TC #2 was drilled and completed with an 8-inch diameter casing to a depth of 120 feet below ground surface (bgs) in 1988. It was tested in 1988 at a rate of 150 gallons per minute (gpm). Water chemistry testing indicates that the IW meets all California drinking water standards (CDWS). As of October 2002, the well had silted in 20 feet to a depth of 100 feet bgs.

- An observation well (OW) was drilled and completed in October 2002 to a depth of 100 feet bgs at a location 123 feet east of the IW. Three shallow piezometers (P1 through P3) were installed between the IW and Squaw Creek. Pressure transducers were installed in the IW, OW, P1, P2, P3, and three nearby shallow monitoring wells (SVLMW-1, MW99-01, and MW99-02).

- Step-drawdown testing of the IW was performed at rates of 65, 100, 200, and 230 gpm in May 2003. Well rehabilitation was then performed and the well was cleaned out to its original depth of 120 feet bgs. A second step-drawdown test was performed at rates of 52, 101, and 154 gpm.

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- Constant rate aquifer testing was performed at a rate of 142 gpm for 78 hours. Water levels were monitored both manually and using a pressure transducer in the pumping well IW and seven monitoring wells.

- Water was treated in an ion-exchange water treatment system to reduce nitrate concentrations before discharge into Squaw Creek. Water samples were collected initially and every 12 hours of the discharge water after treatment and at two locations in Squaw Creek (50 upstream and 50 feet downstream of the discharge location).

- Aquifer testing data were analyzed and input into the Squaw Valley Groundwater Model by Derrik Williams, and the model was recalibrated using the aquifer testing results. Model simulations were then performed to assess the impact of well pumping on municipal water supply availability, flows in Squaw Creek, and the existing Plumpjack hydrocarbon plume. Three scenarios were simulated: pumping for Plumpjack's expansion only (10 gpm), Plumpjack's expansion and Intrawest Phases 3 and 4 (57 gpm), and the maximum well pumping rate of 142 gpm.

Based on our work and Derrik Williams' work completed to date, we have reached the following conclusions:

- Water level contour maps indicate that groundwater flows generally northeast parallel to and towards Squaw Creek in the area of the IW under a gradient of 0.01 feet/foot (ft/ft). Regional groundwater levels rose due to snow melt during the constant rate aquifer test between 0.35 and 1.01 feet and water level corrections were applied to the drawdown data. Impacts on water levels due to pumping the IW for 78 hours were 2.25 feet in the semi-confined aquifer 123 feet east of IW, and ranged from not measurable adjacent to Squaw Creek to 0.2 feet in the shallow unconfined aquifer 80 feet south of the IW. Groundwater flow directions within the shallow aquifer connected to Squaw Valley Creek at the conclusion of the aquifer test were similar to non-pumping conditions with groundwater discharge continuing to Squaw Creek during the aquifer test. The groundwater gradient in the immediate vicinity of Squaw Creek flattened by 0.001 ft/ft during the aquifer test resulting in an insignificant change in flow rate towards the creek.
- Pumping capacity of the IW declined from a sustainable pumping rate of 200 gpm prior to well rehabilitation to 142 gpm after well deepening and rehabilitation. The pumping rate after well rehabilitation is similar to the pumping rate in 1988 (150 gpm). Pumping activities for 15 years resulted in increased well capacity most likely due to removal of fine-grained particles in the vicinity of the well. Fine-grained sand was produced during those 15 years. Rehabilitation of the well by mechanical means (swabbing and bailing) most likely drew in additional fine-grained sand, reduced the porosity of the aquifer materials in the vicinity of the well, and decreased the well capacity. Additional well development for a period of 40 hours did not significantly increase the well capacity. It is recommended that the well be re-tested after the summer operation season.
- Aquifer testing analysis resulted in characterization of the aquifer as an unconfined to semi-confined aquifer with vertical anisotropy. The horizontal hydraulic conductivity

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value ranged between 18 and 30 feet/day, vertical hydraulic conductivity value ranged from 0.15 to 1.5 feet/day, and a storage coefficient of 2×10^{-4} was calculated. Model calibration resulted in the use of an increased horizontal hydraulic conductivity value of 60 feet/day, a vertical hydraulic conductivity of 0.5 feet/day, and a storage coefficient of 2×10^{-4}.

- Model simulations indicate that the Plumpjack IW could be used solely for the purpose of supplying the Plumpjack expansion with only minimal impact on the current water supply wells, minimal impact on flows in Squaw Creek, and no impact on the Plumpjack hydrocarbon plume.
- The Plumpjack IW could supply water beyond the needs of the Plumpjack expansion, but would need to be operated in coordination with other municipal wells in the valley to avoid impacts to existing water supply wells during a repeat of the 1994 drought or during consecutive years of the 1994 drought. The Plumpjack well was included in previous model simulations to estimate maximum pumping rates for the Squaw Valley Basin.
- Simulated impacts to flows in Squaw Creek were minimal even under a continuous IW pumping rate of 142 gpm for three years. The maximum decrease in flow in Squaw Creek was estimated to be 0.01 cubic feet per second (cfs) or 5 gpm. This decrease would not be measurable.
- Simulated impacts on hydrocarbons in groundwater east of Plumpjack Squaw Valley Inn plume were also minimal even under a continuous IW pumping rate of 142 gpm for three years. Flow directions altered slightly under the 57 gpm and 142 gpm simulations but the impact on hydrocarbon migration was minimal.

We appreciate the opportunity to prepare this report presenting the procedures, findings, and conclusions of our investigation and evaluation to date. Please call the undersigned with any questions or to discuss the report contents.

Sincerely,

KLEINFELDER, INC.

David J. Herzog, C.E.G.
Senior Engineering Geologist

Brian Peck, R.G.
Hydrogeologist

DJH:BP:vd

cc: Suzanne Wilkins, K. B. Foster
Rick Lierman, SVPSD
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RESULTS OF AQUIFER TESTING AND IMPACT ANALYSIS
PLUMPJACK IRRIGATION WELL
OLYMPIC VALLEY, CALIFORNIA

1. INTRODUCTION

This report presents results of aquifer testing and impact analysis for the Plumpjack Irrigation Well (IW) between May 5 and 19, 2003.

1.1 Regional Geology

The site is located in Squaw Valley near the eastern edge of the Sierra Nevada geomorphic province. The mountain ridges surrounding the site primarily consist of volcanic rocks of Tertiary age. These rocks are generally andesitic in composition, and strike roughly N75E and dip at a low angle to the southeast. To the west of Squaw Valley andesitic rocks of volcanic origin overlie and are in fault contact with older granitic intrusive rocks of the Sierra Nevada Batholith. Faulting and erosion have exposed these granitic rocks at the western end of the valley.

The principle landforms of Squaw Valley resulted from alpine glaciation which occurred during the Tahoe and Tioga glacial periods of the Pleistocene Epoch. Several lateral moraines flank the valley sides and a large terminal moraine sits at the entrance of the valley. The terminal moraine dammed a lake that accumulated fine-grained sediment resulting in the present grassy meadow that covers much of the valley floor.

1.2 Regional Hydrogeology

There are basically two groundwater regimes in the region: 1) fracture flow in the granitic batholith and volcanic rocks, and 2) primary flow in the younger glacial and fluvial deposits. In Squaw Valley the lower slopes and valley floor are covered with Quaternary unconsolidated glacial, alluvial and lake deposits. Repeated glaciation events have caused periodic ponding and lake development in the 400-acre valley floor. The complex depositional history has created highly variable sedimentary units that are laterally discontinuous. These discontinuities make stratigraphic correlation difficult and result in significant lateral heterogeneity of aquifer hydraulic properties.

The aquifer underlying Squaw Valley is a complex, unconfined and semi-confined system of varying thickness. This system may be divided into "upper" and "lower" aquifers based on the presence of clay beds between the deposits. Movement of groundwater in both aquifer systems is generally in an eastward direction, paralleling the flow of Squaw Creek. Both aquifer systems are subject to seasonal fluctuations of static water levels because of the seasonal recharge cycle dominated by snowmelt and by varying precipitation cycles within the valley.

The base of the "upper" aquifer system is generally located 10 to 25 feet below ground surface. Recharge of the upper aquifer system comes from infiltration of precipitation and snowmelt. Stream gauging data indicates the upper aquifer system discharges into Squaw Creek making it a gaining stream (Kleinfelder, 1987).

The "lower" aquifer system consists of water-bearing deposits below relatively impermeable, semi-confining clay beds that separate it from the "upper" aquifer system to depths of approximately 130 feet below ground surface (bgs). Thickness, depth and lateral extent of the clay beds is variable throughout the valley. In some areas the confining beds may be semi-permeable or missing altogether. Recharge of the "lower" aquifer system appears to be from infiltration of snowmelt between the contact boundary of hard rock valley walls and valley deposits, and through downward vertical migration of water from the upper aquifer system. In addition, minor recharge may be coming from hydrothermal fluids upwelling from fracture zones in the bedrock. This phenomenon occurs predominantly in the northeast portions of the valley. In general, the "lower" aquifer system does not have significant impact on the surface water system since it does not appear to be affected by, nor does it appear to affect, surface runoff in the valley.

Andesitic and granitic bedrock forms a basal groundwater system characterized by fracture-flow. The primary hydraulic conductivity of these rocks is low; groundwater flow occurs primarily where secondary hydraulic conductivity has developed in fracture zones, open joints, and along bedding plane weaknesses in the volcanics. The bedrock has a low hydraulic conductivity relative to the glacial outwash alluvium, but significant groundwater can be developed from fracture zones within the bedrock.

Municipal water supplies within Squaw Valley are produced by the Squaw Valley Public Service District (SVPSD) and the Squaw Valley Mutual Water Company (SVMWC). Both entities have water supply wells in the area east of Plumpjack Squaw Valley Inn at locations shown in Plate 1. The nearest water supply well to the Plumpjack IW is SVPSD Well No. 2, located 1,450 feet east.

1.3 Site Hydrogeologic Setting And Well Construction

The Plumpjack IW was drilled and completed with an 8-inch diameter casing to a depth of 120 feet below ground surface (bgs) in 1988. A well log is presented in Appendix A. Geologic units encountered consisted of alluvial and glacial deposits of sand, gravel, and minor clay. The well was screened from a depth of 61 to 120 feet bgs. It was tested in 1988 at a rate of 150 gallons per minute (gpm) for four hours with a pumping level after testing of 100 feet bgs. In May 2003, the depth of the IW was 100 feet bgs.

1.4 Project Objectives

Project objectives were to evaluate the impact of long-term pumping of the Plumpjack IW on the existing municipal well field(s), on flow in Squaw Creek, and on known groundwater contaminant plumes. These objectives were met by designing and performing an aquifer test of the IW; monitoring water levels before, during, and after aquifer testing; and performing model simulations for a three year period including two consecutive years of a simulated 1994 drought.

2. FIELD ACTIVITIES

Field activities consisted of drilling and completing an observation well (OW); installing three shallow piezometers; monitoring water levels in the IW, OW, three piezometers, and three shallow monitoring wells; rehabilitating the IW; and performing step-drawdown and constant drawdown aquifer testing of the IW between May 5 and 19, 2003. Location of wells and piezometers are shown in Plate 2. Well construction for all wells monitored are presented in Table 1.

2.1 Observation Well and Piezometer Installation

Observation Well

An observation well (OW) was drilled and installed approximately 123 feet east of the IW (Plate 2) using the air hammer drilling method with Odex system. Two-inch PVC well screen was installed from the base of the well (100 feet bgs) to a depth of 60 feet bgs. Blank casing was then installed to ground surface. A well seal consisting of cement and bentonite was installed from a depth of 55 feet to ground surface. The geologic log is presented in Appendix A. Geologic units encountered consisted of interbedded sand, gravelly sand, sandy gravel, and silty sand.

Piezometers

Three 1-inch diameter stainless steel piezometers (P1 through P3) were installed at distances of 10, 40, and 70 feet south of Squaw Creek to depths of approximately 10 feet bgs using a hand driver. The piezometers consisted of a five-foot section of well screen and a five-foot section of blank casing.

Pressure transducers were installed in the IW, OW, P1, P2, P3, and three nearby shallow monitoring wells (SVLMW-1, MW99-01, and MW99-02) as shown in Plate 2.

2.2 Step-Drawdown Testing And Well Rehabilitation

Water levels were monitored prior to (May 5, 2003) and after (May 19, 2003) all aquifer testing with results presented in Table 1. Step-drawdown testing of the IW was performed at rates of 65, 100, 200, and 230 gpm on May 5, 2003. Well rehabilitation was then performed consisting of bailing, brushing, and swabbing and the well was deepened to a depth of 120 feet bgs. A second step-drawdown test was performed at rates of 52, 101, and 154 gpm.

2.3 Constant Discharge Aquifer Testing

The IW was tested at an average rate of 142 gpm for a period of approximately 78 hours between May 13 and 16, 2003. Water levels were monitored in the IW and the seven monitoring points prior to, during, and for several days after the test. Water level and drawdown data is presented in Appendix B.

2.4 Discharge Monitoring

Water was treated in an ion-exchange water treatment system before discharge into Squaw Creek under Permit WDID NO. 6A310211001, General Board Order No. 6-98-36-12 issued May 6, 2003 by the Lahontan Regional Water Quality Control Board. Water samples were collected initially and every 12 hours of the discharge water after treatment and at two locations in Squaw Creek (50 upstream and 50 feet downstream of the discharge location). Laboratory analytical reports are contained in Appendix C.

3. DISCUSSION

This section describes the results of water level measurements, aquifer testing, groundwater model simulations, and discharge sampling.

3.1 Groundwater Flow

Water level contour maps were prepared before, during, and after the constant-discharge aquifer test as shown in Plates 3 through 5. Plates 3 through 5 are very similar and indicate the groundwater flow direction to the northeast under a hydraulic gradient of 0.01 feet/foot. Groundwater discharges into Squaw Creek with the groundwater elevation higher than the surface elevation of Squaw Creek. Regional groundwater elevations rose between 0.35 and 1.01 feet across the area from May 13, 2003 (Plate 3) through May 19, 2003 (Plate 5) with the largest increase closer to the mountains (south) and the smallest increase in the vicinity of Squaw Creek. It appears that Squaw Creek moderates the rising groundwater levels.

Plate 4 presents the model-simulated groundwater contours at the end of test pumping and omits the groundwater elevations for the pumping well IW due to unknown well efficiency. All other wells are screened in the upper aquifer. Effects on water levels due to pumping the IW for 78 hours were 2.25 feet in the semi-confined aquifer (well OW) 123 feet east of IW, and ranged from not measurable adjacent to Squaw Creek to 0.2 feet in the shallow unconfined aquifer 80 feet south of the IW. Therefore, it appears that the impacts of pumping are a factor of 10 greater in the lower semi-confined aquifer than in the sahllow unconfined aquifer. Groundwater flow directions within the shallow aquifer connected to Squaw Valley Creek at the conclusion of the aquifer test were similar to non-pumping conditions with groundwater discharge continuing to Squaw Creek during the aquifer test. The groundwater gradient in the immediate vicinity of Squaw Creek appeared to be slightly flatter (0.001 ft/ft) during the aquifer test resulting in an insignificant change in flow rate towards the creek.

3.2 Aquifer Testing

Aquifer test data are presented in Appendix B with semi-logarithmic plots of water level drawdown versus time for the IW and OW presented in Plates 6 and 7. Aquifer test data were analyzed by Derrik Williams with results presented in Appendix D.

Mr. Williams analyzed the aquifer test by two methods: as a leaky confined aquifer or as an unconfined aquifer with vertical anisotropy. The horizontal hydraulic conductivity value ranged between 18 and 30 feet/day, vertical hydraulic conductivity value ranged from 0.15 to 1.5 feet/day, and a storage coefficient of 2 x 10^{-4} was calculated. Results are discussed in Appendix D.

3.3 Model Simulations

The Squaw Valley Groundwater Model was calibrated by simulating the aquifer test. Model simulations were then performed for a three year period including two years of the 1994 drought to assess the impact of well pumping on municipal water supply availability, flows in Squaw Creek, and the existing Plumpjack hydrocarbon plume. Three scenarios were simulated: pumping for Plumpjack's expansion only (10 gpm), Plumpjack's expansion and Intrawest Phases 3 and 4 (57 gpm), and the maximum well pumping rate of 142 gpm. Results are presented in Appendix D.

3.4 Discharge And Receiving Water Monitoring

Results of discharge and receiving water monitoring are presented in Table 2. As shown all discharge water samples met the water quality objectives for all analytes with the exception of some measured total dissolved solids (TDS) values. These measured TDS values appeared to be inaccurate as compared to the conductivity values. The TDS values were recalculated using the sum of the cations and anions and all calculated TDS values were below the water quality objective.

4. CONCLUSIONS

Based on our work and Derrik Williams' work completed to date, we have reached the following conclusions:

- Water level contour maps indicate that groundwater flows generally northeast parallel to and towards Squaw Creek in the area of the IW under a gradient of 0.01 feet/foot (ft/ft). Regional groundwater levels rose during the constant rate aquifer test between 0.35 and 1.01 feet and water level corrections were applied to the drawdown data. Impacts on water levels due to pumping the IW for 78 hours were 2.25 feet in the semi-confined aquifer 123 feet east of IW, and ranged from not measurable adjacent to Squaw Creek to 0.2 feet in the shallow unconfined aquifer 80 feet south of the IW. Groundwater flow directions within the shallow aquifer connected to Squaw Valley Creek at the conclusion of the aquifer test were similar to non-pumping conditions with groundwater discharge continuing to Squaw Creek during the aquifer test. The groundwater gradient in the immediate vicinity of Squaw Creek flattened by 0.001 ft/ft during the aquifer test resulting in an insignificant change in flow rate towards the creek.
- Pumping capacity of the IW declined from a sustainable pumping rate of 200 gpm prior to well rehabilitation to 142 gpm after well deepening and rehabilitation. The pumping rate after well rehabilitation is similar to the pumping rate in 1988 (150 gpm). Pumping activities for 15 years resulted in increased well capacity most likely due to removal of fine-grained particles in the vicinity of the well. Fine-grained sand was produced during those 15 years. Rehabilitation of the well by mechanical means (swabbing and bailing) most likely drew in additional fine-grained sand, reduced the porosity of the aquifer materials in the vicinity of the well, and decreased the well capacity. Additional well development for a period of 40 hours did not significantly increase the well capacity. It is recommended that the well be retested after the summer operation season.
- Aquifer testing analysis resulted in characterization of the aquifer as an unconfined aquifer with vertical anisotropy. The horizontal hydraulic conductivity value ranged between 18 and 30 feet/day, vertical hydraulic conductivity value ranged from 0.15 to 1.5 feet/day, and a storage coefficient of 2×10^{-4} was calculated. Model calibration

resulted in the use of an increased horizontal hydraulic conductivity value of 60 feet/day, a vertical hydraulic conductivity of 0.5 feet/day, and a storage coefficient of 2×10^{-4}.

- Model simulations indicate that the Plumpjack well could be used solely for the purpose of supplying the Plumpjack expansion with only minimal impact on the current water supply, minimal impact on flows in Squaw Creek, and no impact on the Plumpjack hydrocarbon plume.
- The Plumpjack well could supply water beyond the needs of the Plumpjack expansion but would need to be operated in coordination with other municipal wells in the valley to avoid impacts to existing water supply wells during a repeat of the 1994 drought or during consecutive years of the 1994 drought. The Plumpjack well was included in previous model simulations to estimate maximum pumping rates for the Squaw Valley Basin.
- Simulated impacts to flows in Squaw Creek were minimal even under a continuous IW pumping rate of 142 gpm for three years. The maximum decrease in flow in Squaw Creek was estimated to be 0.01 cubic feet per second (cfs) or 5 gpm. This decrease would not be measurable.
- Simulated impacts on the Plumpjack hydrocarbon plume were also minimal even under a continuous IW pumping rate of 142 gpm for three years. Flow directions altered slightly under the 57 gpm and 142 gpm simulations but the impact on plume migration was minimal.

5. LIMITATIONS

It should be recognized that definition and evaluation of environmental conditions is a complex and inexact science. Judgments leading to findings and recommendations are generally made with an incomplete knowledge of the environmental and subsurface conditions present. More extensive studies, including additional subsurface investigations, can be conducted to further reduce the inherent uncertainties beyond the level associated with this assessment. If Plumpjack Squaw Valley Inn wishes to further reduce the uncertainty associated with this assessment, Kleinfelder should be notified for additional consultation.

Kleinfelder performed this assessment in accordance with generally accepted standards of care which exist in California at the time the work was performed. No warranty, express or implied, is made. Use of this document is prohibited by unauthorized parties, unless approved by Kleinfelder as provided by the Application for Authorization to Use, which is included in Appendix E.

TABLES

Table 1

Well Construction Water Level Data
Plumpjacks Aquifer Test

Well	Total Depth	Screened Interval	Measuring Point Elevation	Pre Test 5/13/03	Test End 5/16/03	Full Recovery 5/19/03
	FEET	*FEET*	*FT MSL*	*FT MSL*	*FT MSL*	*FT MSL*
P1	10	60 TO 120	6197.75	6193.51	6193.93	6193.92
P2	10	60 TO 100	6200.99	6193.80	6194.10	6194.21
P3	10	10 TO 30	6201.56	6194.67	6194.96	6195.02
IW	120	10 TO 25	6211.72	6195.73	6122.39	6196.67
SVLMW1	30	10 TO 25	6210.63	6196.02	6196.78	6196.95
OW	100	5 TO 10	6209.41	6195.23	6194.05	6196.24
99-02	25	5 TO 10	6210.30	6193.69	6194.42	6194.55
99-01	25	5 TO 10	6204.25	6191.90	6192.53	6192.60
SQUAW CK						6193.39

<u>Table 2</u>

Summary of Discharge and Receiving Water Sampling
Plumpjacks Aquifer Test

	Nitrate	Nitrite	TKN	Total Nitrogen	Total Phosphorus	Turbidity	TDS (measured)	TDS (calculated)	Conductivity	pH	Iron
	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	mg/L	mg/L	uS/cm	units	mg/L
Water Quality Objective	0.05		0.13	0.13	0.02		85				0.13
IW											
5/06/03 1125	<0.010	<0.010	0.11	0.11	0.0082	0.28	100	44	80	5.55	<0.010
5/13/03 2030	<0.010	<0.010	0.093	0.093	0.0051	0.61	46	46.3		5.05	0.030
5/14/03 0800	<0.010	<0.010	0.070	0.070	0.0065	0.40	54	46.3		5.18	<0.020
5/14/03 2000	<0.010	<0.010	0.053	0.053	<0.0050	0.18	96	42.5	100	5.28	0.029
5/15/03 0800	<0.010	<0.010	0.085	0.085	<0.0050	<0.10	96	47.3	100	5.48	0.012
5/15/03 2058	<0.010	<0.010	0.082	0.082	<0.0050	0.47	90	47.2	100	5.70	<0.010
5/16/03 0900	<0.010	<0.010	0.073	0.073	<0.0050	<0.10	99	41.2	80	5.10	<0.010
SQ #1											
5/06/03 1125	0.17	<0.010	0.092	0.26	<0.0050	0.81	85		50	6.55	<0.010
5/13/03 2035	0.16	<0.010	0.10	0.26	0.011	1.4	17			6.69	0.065
5/14/03 0810	0.20	<0.010	0.074	0.27	0.0071	1.1	31			6.69	0.042
5/14/03 2010	0.19	<0.010	0.29	0.48	0.044	7.7	63		55	6.69	0.36
5/15/03 0810	0.24	<0.010	0.11	0.35	0.055	1.3	68		50	7.16	0.078
5/15/03 2102	0.23	<0.010	0.14	0.37	0.024	4.4	53		50	7.00	0.22
5/16/03 0910	0.21	<0.010	0.11	0.32	0.0079	0.93	54		46	6.58	0.036
SQ #2											
5/06/03 1125	0.13	<0.010	0.069	0.20	0.0085	0.58	79		50	6.33	<0.010
5/13/03 2040	0.13	<0.010	0.091	0.21	0.019	1.1	35			6.59	0.071
5/14/03 0815	0.16	<0.010	0.074	0.23	0.0087	0.89	35			6.58	0.036
5/14/03 2015	0.14	<0.010	0.17	0.31	0.040	6.3	57		47	6.81	0.25
5/15/03 0815	0.19	<0.010	0.13	0.32	0.0087	0.92	81		46	7.08	0.076
5/15/03 2110	0.20	<0.010	0.15	0.35	0.018	3.6	57		46	6.88	0.17
5/16/03 0915	0.18	<0.010	0.13	0.31	0.010	0.77	70		60	6.46	0.035

TKN = Total Kjeldahl Nitrogen
TDS = Total Dissolved Solids

PLATES

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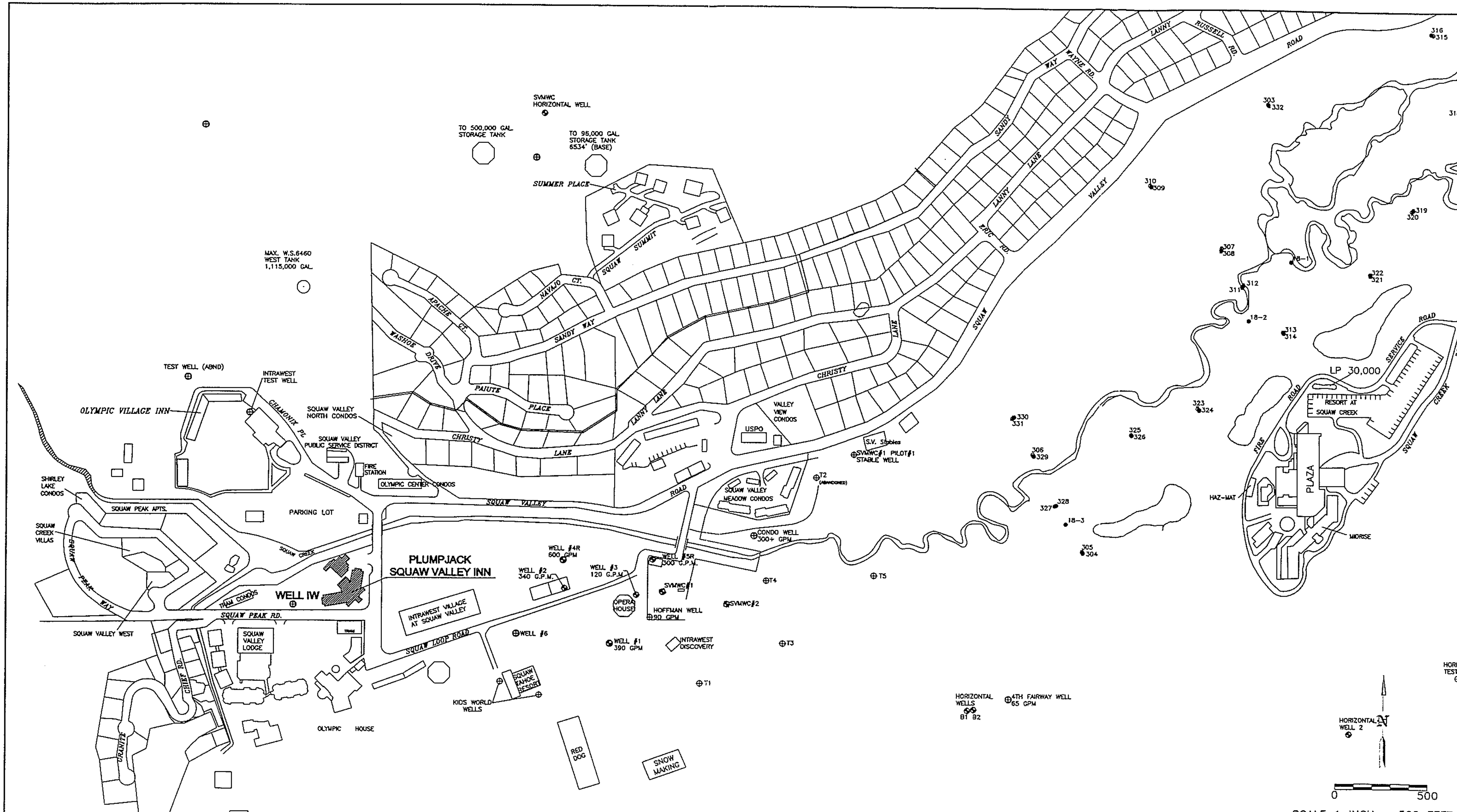


LEGEND

- PRODUCTION WELL
- TEST WELL
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL

(WELL LOCATIONS ARE APPROXIMATE)

KLEINFELDER
4875 LONGLEY LANE
RENO, NEVADA 89502-5953
Tel. (775) 689-7800

PROJECT NO. 22705.01

WELL LOCATION MAP

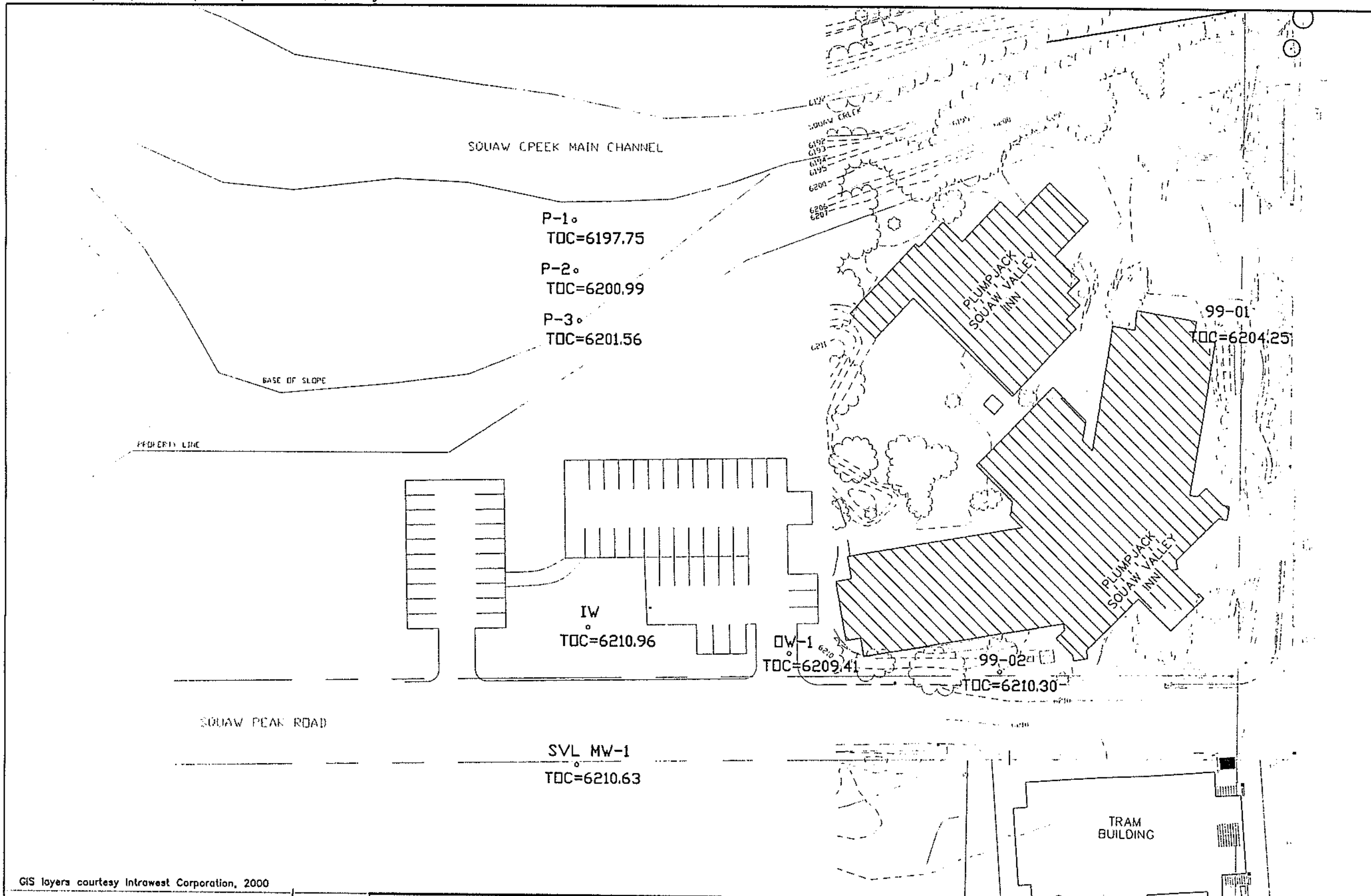
PLUMPJACK
SQUAW VALLEY INN
SQUAW VALLEY, CALIFORNIA

PLATE

1

MAP SOURCE: SQUAW VALLEY PUBLIC SERVICE DISTRICT, 1999

CAD FILE: L:\2003\DRAFTING\22705\22705-P2-5,SITE.dwg



GIS layers courtesy Intrawest Corporation, 2000

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Tel. (775) 689-7800

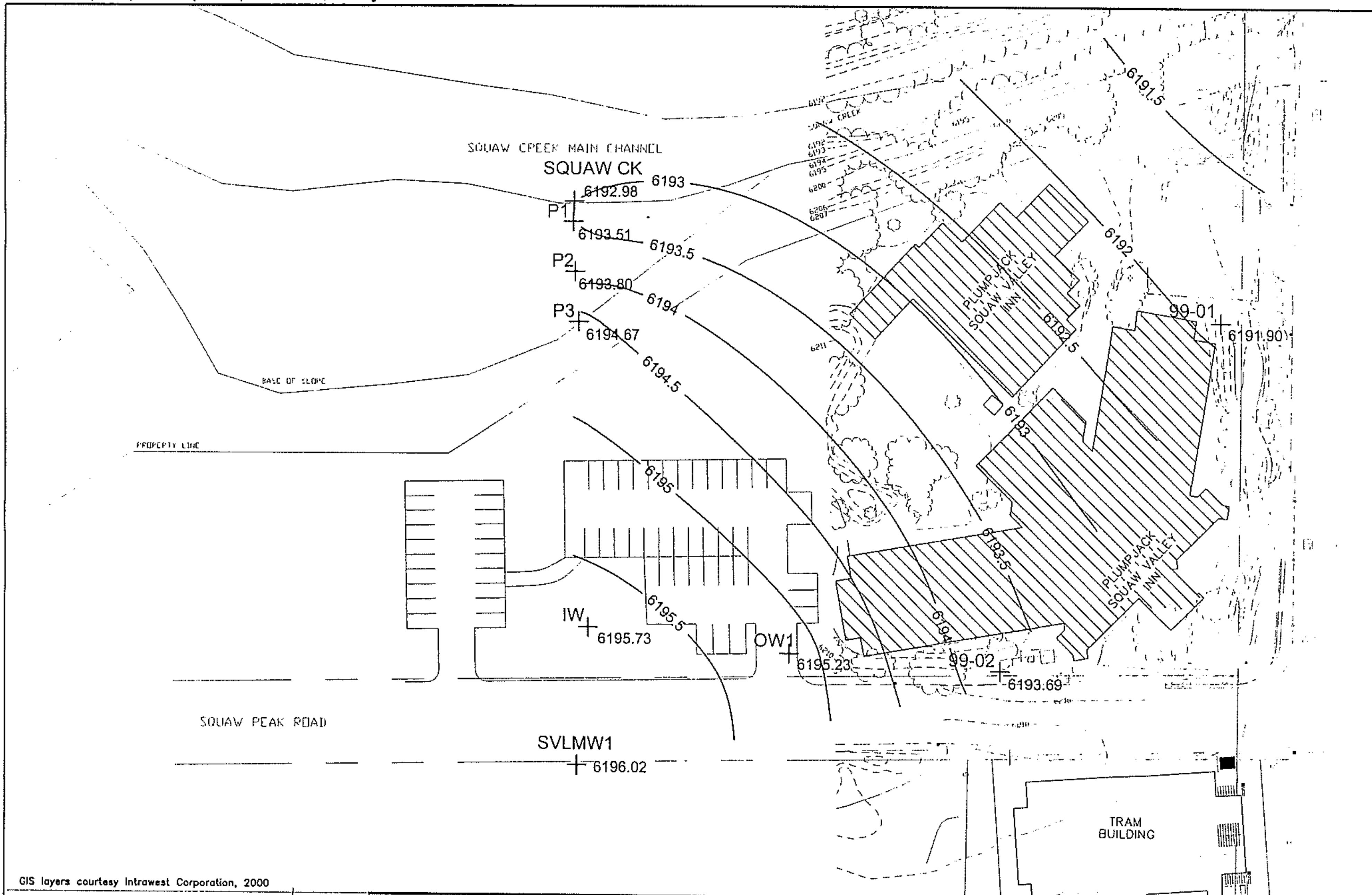
PROJECT NO. 22705.01

SITE MAP WITH WELL LOCATIONS

PLUMPJACK
SQUAW VALLEY INN
SQUAW VALLEY, CALIFORNIA

PLATE
2

CAD FILE: L:\2003\DRAFTING\22705\22705-P2-5,SITE.dwg



GIS layers courtesy Intrawest Corporation, 2000

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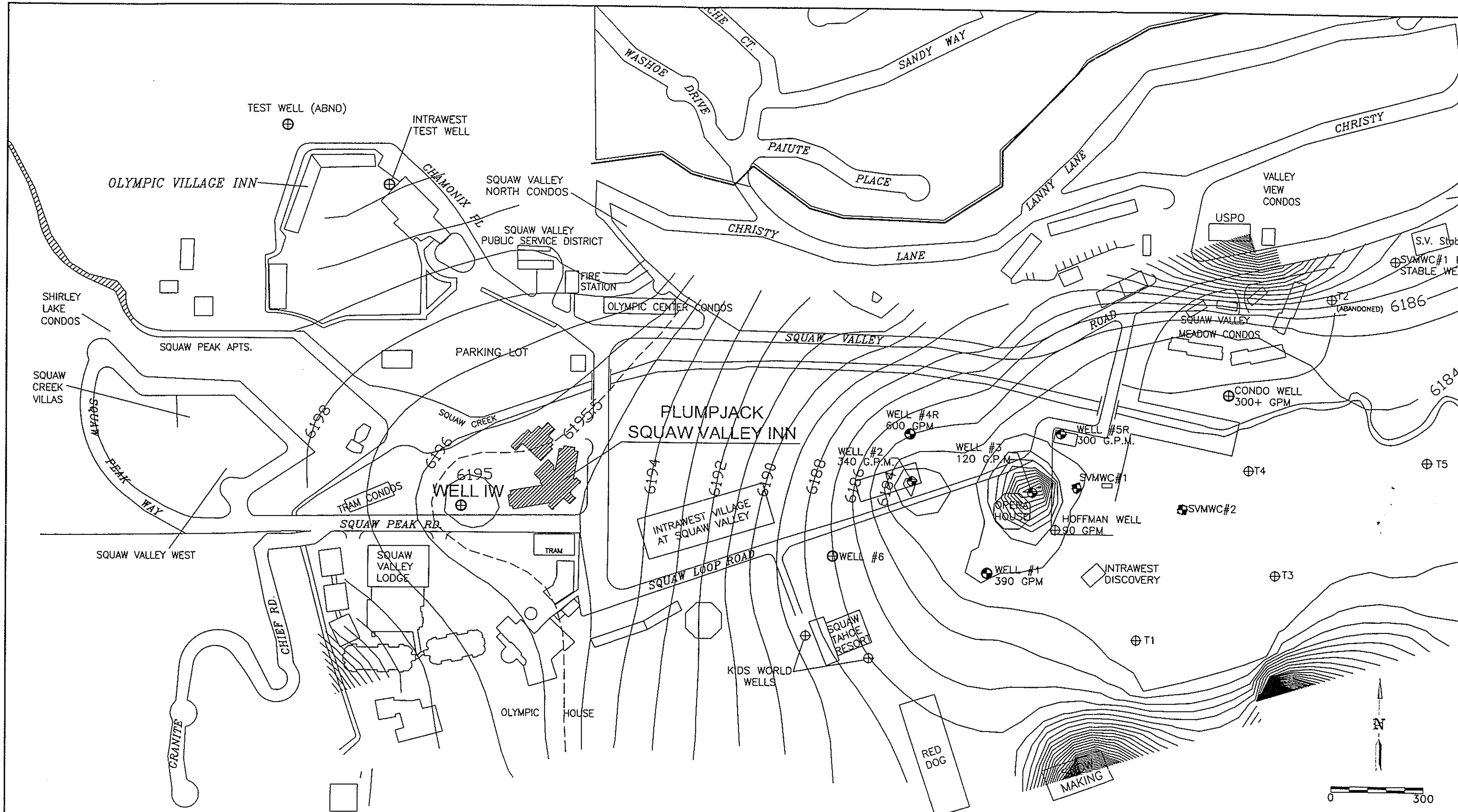
GROUNDWATER CONTOURS PRIOR TO TEST PUMPING

PLUMPJACK
SQUAW VALLEY INN
SQUAW VALLEY, CALIFORNIA

PLATE
3

CAD FILE: U:\2003\DRAFTING\22705\22705-P1Welllocations.DWG



LEGEND

- PRODUCTION WELL
- TEST WELL
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL

(WELL LOCATIONS ARE APPROXIMATE)

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PROJECT NO. 22705.01

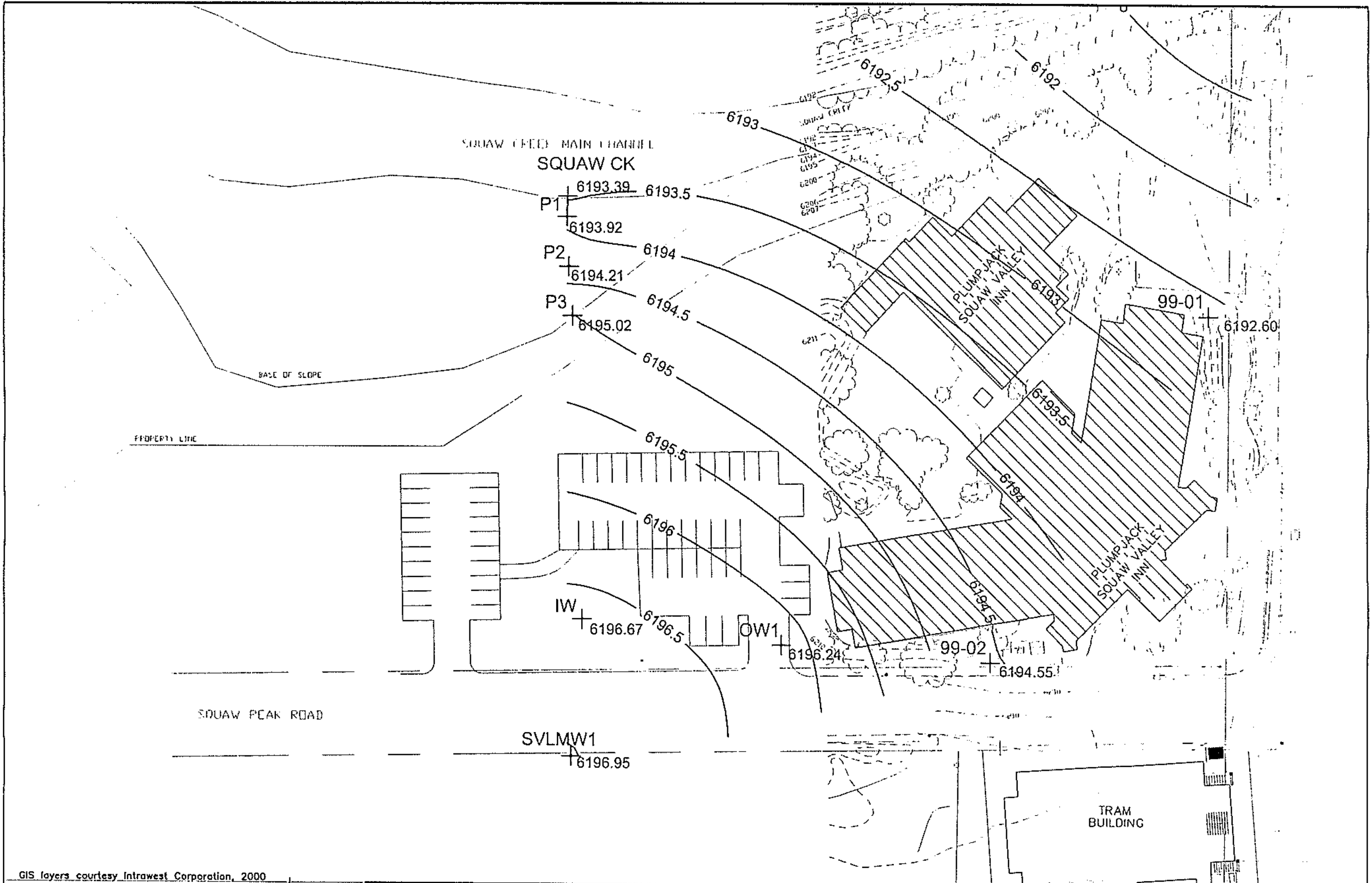
SIMULATED GROUNDWATER CONTOURS AT END OF TEST PUMPING

PLUMPJACK
SQUAW VALLEY INN
SQUAW VALLEY, CALIFORNIA

PLATE
4

MAP SOURCE: SQUAW VALLEY PUBLIC SERVICE DISTRICT, 1999

CAD FILE: L:\2003\DRAFTING\22705\22705-P2-5,SITE.dwg



GIS layers courtesy Intrawest Corporation, 2000

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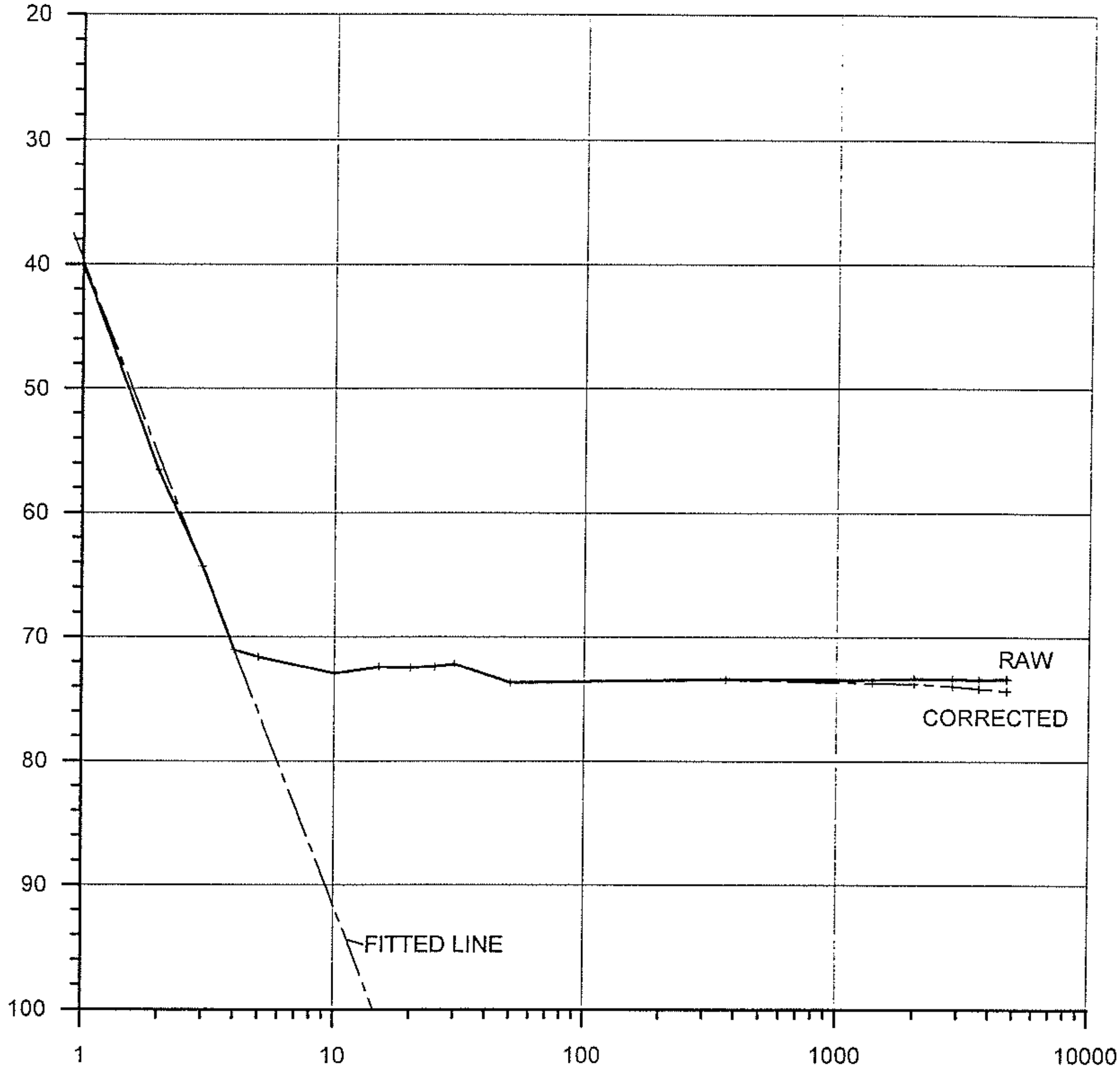
PROJECT NO. 22705.01

GROUNDWATER CONTOURS AFTER TEST PUMPING

PLUMPJACK
SQUAW VALLEY INN
SQUAW VALLEY, CALIFORNIA

PLATE
5

PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
SEMI-LOG PLOT OF IRRIGATION WELL DRAWDOWN



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PROJECT NO. 22705.01

IRRIGATION WELL DRAWDOWN

PLUMPJACK
SQUAW VALLEY INN
SQUAW VALLEY, CALIFORNIA

PLATE

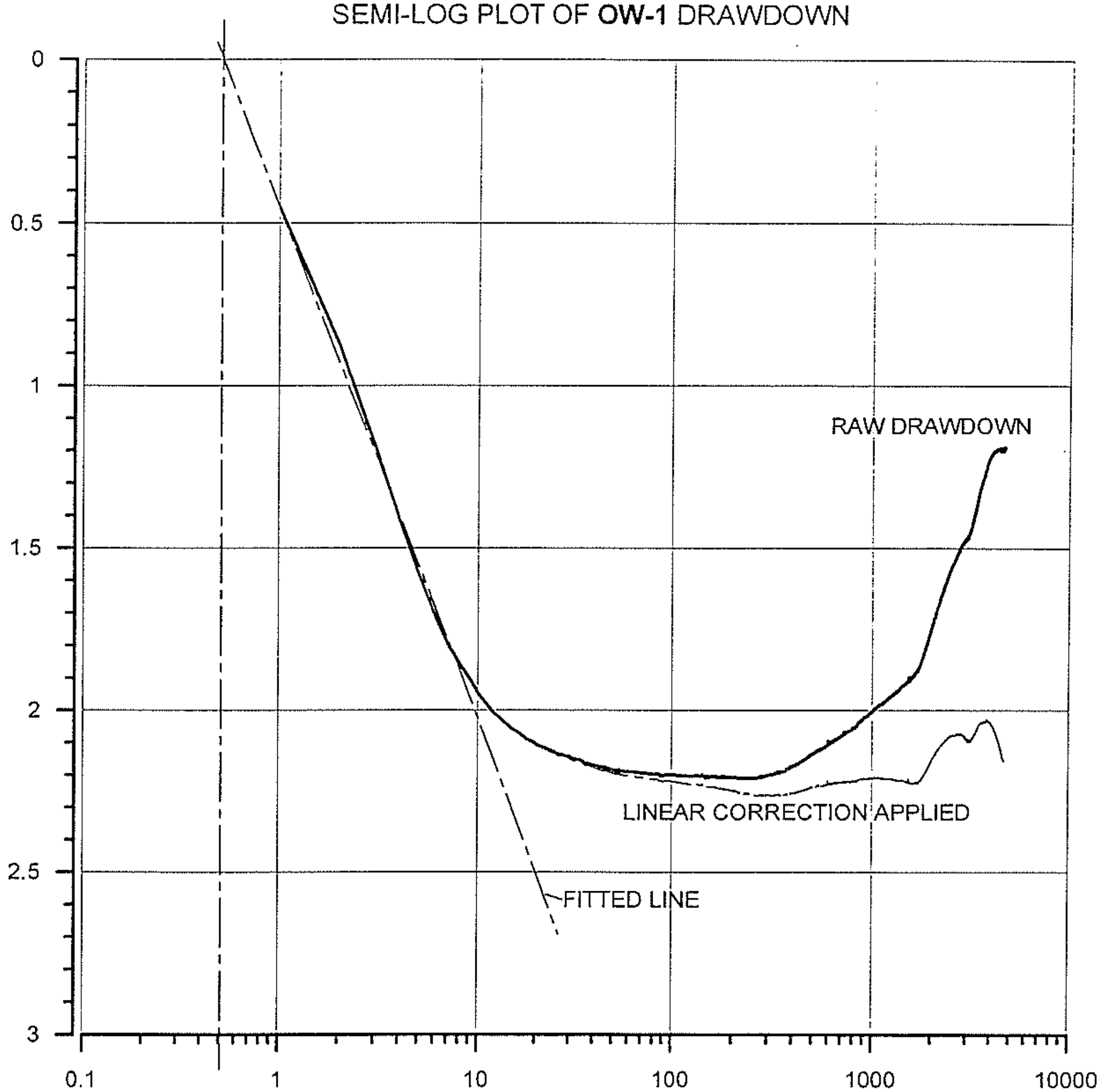
6

CAD FILE: L:\2003\DRAFTING\22705\22705-P6P7.DWG

PLUMPJACK SQUAW VALLEY INN

IRRIGATION WELL AQUIFER TEST

SEMI-LOG PLOT OF **OW-1** DRAWDOWN



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OBSERVATION WELL DRAWDOWN

PLUMPJACK
SQUAW VALLEY INN
SQUAW VALLEY, CALIFORNIA

PLATE

7

PROJECT NO. 22705.01

CAD FILE: L:\2003\DRAFTING\22705\22705-P6P7.DWG

APPENDIX A

Well Construction Logs

Well Graphics	Well Design Info.	Air Pressure psi	Dry Density lbs/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Sample	USCS	SOIL DESCRIPTION
									<u>BROWN GRAVELLY SAND (SW)</u> dry, dense, some silt, medium sand, rounded gravel to 1".
									<u>ORANGE BROWN SAND (SW)</u> dry, medium to coarse sand.
									<u>LIGHT BROWN SANDY GRAVEL (GW)</u> wet, dense, medium to coarse sand, rounded gravel to 1/2". Groundwater encountered at 15'. Gravel increasing at 1".
									<u>ORANGE BROWN GRAVELLY SAND (SW)</u> wet, dense, medium to coarse sand, gravel to 1/4".
									<u>WHITE AND GRAY SAND (SW)</u> wet, dense, occational gravel to 1/2", medium to coarse sand.
									<u>TAN BROWN SAND (SP)</u> wet, medium gravel
									<u>TAN AND GRAY GRAVELLY SAND (SW)</u> wet, dense, medium to coarse sand, gravel to 1/2".
									<u>TAN SAND (SP)</u> wet, dense, fine-grained sand.
									<u>TAN SILTY SAND (SM) wet, dense, fine-grained sand.</u>
									<u>WHITE AND GRAY SAND (SW)</u> some silt, fine to coarse sand.
									<u>BROWN SILTY SAND (SW)</u> wet, fine-grained sand.
									Bottom of well at 100'.

DEPTH IN FEET: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100

DATE:

TOTAL DEPTH: 100.0 feet

LOGGED BY:

EQUIPMENT:

KLEINFELDER

PLUMPJACKS

OLYMPIC VALLEY, CALIFORNIA

PLATE

PROJECT NO. 22705.01

LOG OF OW-1

ORIGINAL
File with DWR

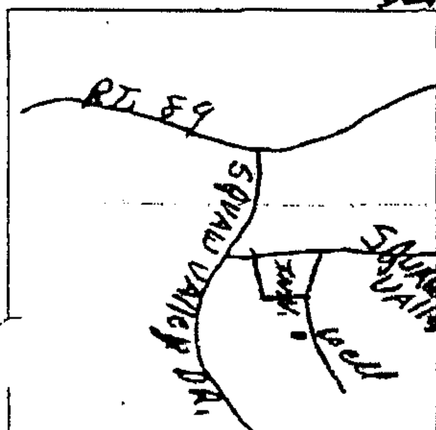
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in
No. 271301

Notice of Intent No. 182549
Local Permit No. or Date 777 Larry Chayam
State Well No.
Other Well No. 16N16E31

(1) OWNER: Name Squaw Valley Ltd
Address 50 California St. Suite 3215
City San Francisco Calif ZIP 94111

(2) LOCATION OF WELL (See instructions):
County PLACER Owner's Well Number 271301
Well address if different from above 1920 Squaw Valley Rd Olympic Vly
Township 16 Range 16 Section 31
Distance from cities, roads, railroads, fences, etc.
approx. 8 mi. S. of Truckee
off Rt. 89 at Squaw Valley Ski Resort



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☑ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Municipal ☑
Other ☐
(Describe)

(5) EQUIPMENT:
Rotary ☑ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☐ No ☑ Size
Diameter of bore
Packed from 60 to 120

(7) CASING INSTALLED:
Steel ☑ Plastic ☐ Concrete ☐

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	120		.188	61	120	3/32 x 2½ x 2 double

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☑ No ☐ If yes, to depth 60 ft.
Were strata sealed against pollution? Yes ☐ No ☑ Interval ft.
Method of sealing Pumped neat Cement

(10) WATER LEVELS:
Depth of first water, if known 14 ft.
Standing level after well completion 22 ft.

(11) WELL TESTS:
Was well test made? Yes ☑ No ☐ If yes, by whom? driller
Type of test Pump ☐ Bailer ☐ Air lift ☑
Depth to water at start of test 22 ft. At end of test 100 ft.
Discharge 250 gal/min after 4 hours Water temperature Cool
Chemical analysis made? Yes ☐ No ☑ If yes, by whom?
Was electric log made Yes ☐ No ☑ If yes, attach copy to this report

(12) WELL LOG: Total depth 120 ft. Completed depth 120 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	3	gravel & sand w/clay
3	14	fine sand w/clay
14	61	coarse sand & fine gravel
61	74	sand w/clay lenses
74	111	sand w/gravel layers
111	120	sand & fine gravel

CONFIDENTIAL
NOT FOR PUBLIC USE
WATER CODE SEC. 13752

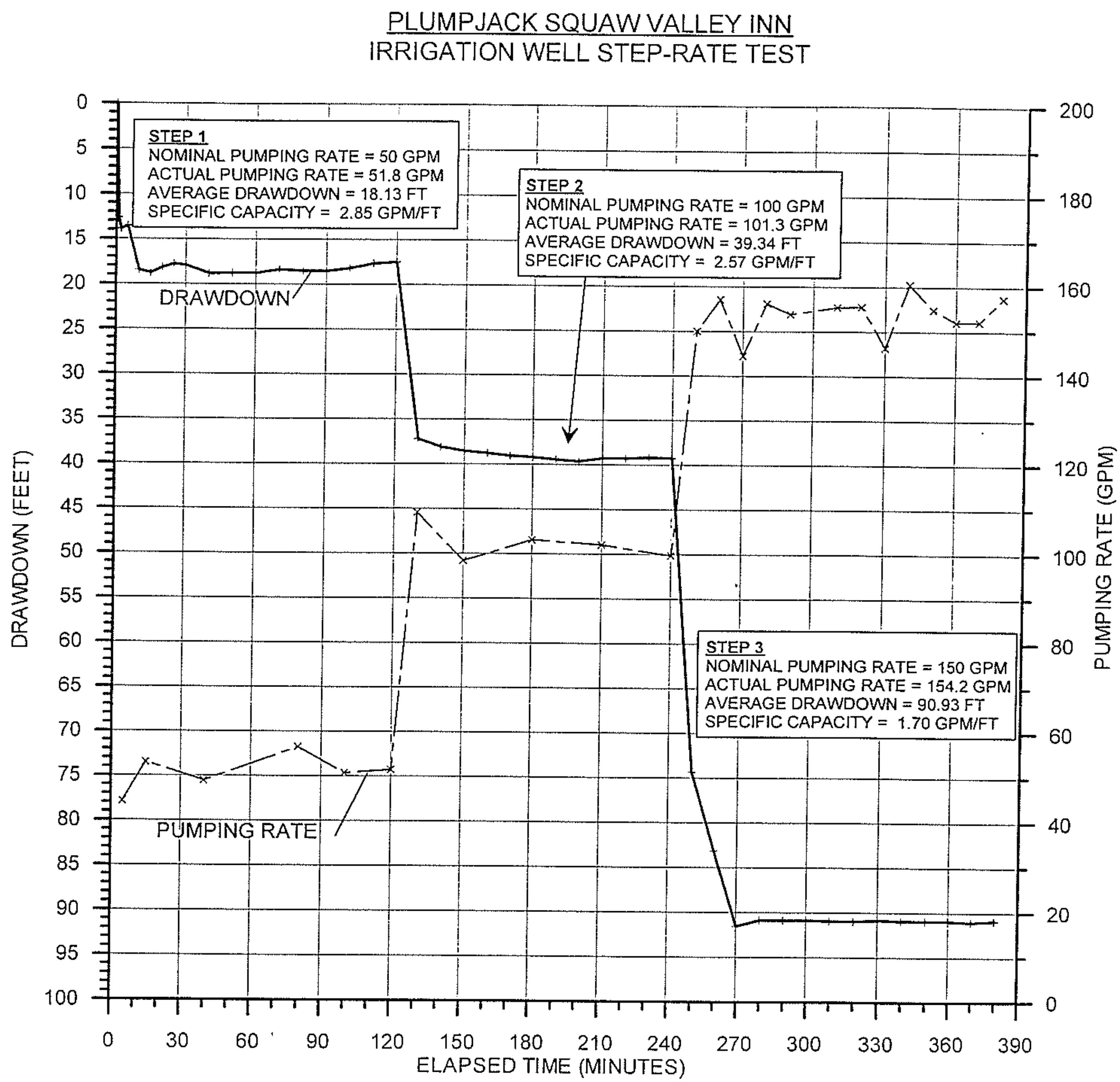
Work started 9-8 1988 Completed 9-10 1988

WELL DRILLER'S STATEMENT: 01203
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Signed [signature] (Well Driller)
NAME Paul Williams Lahontan Well Drilling
(Person, firm, or corporation) (Typed or printed)
Address P.O. Box 8277
City Truckee Ca. ZIP 95737
License No. 345656 Date of this report 9-17-88

DWR 188 REV. 12-80
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

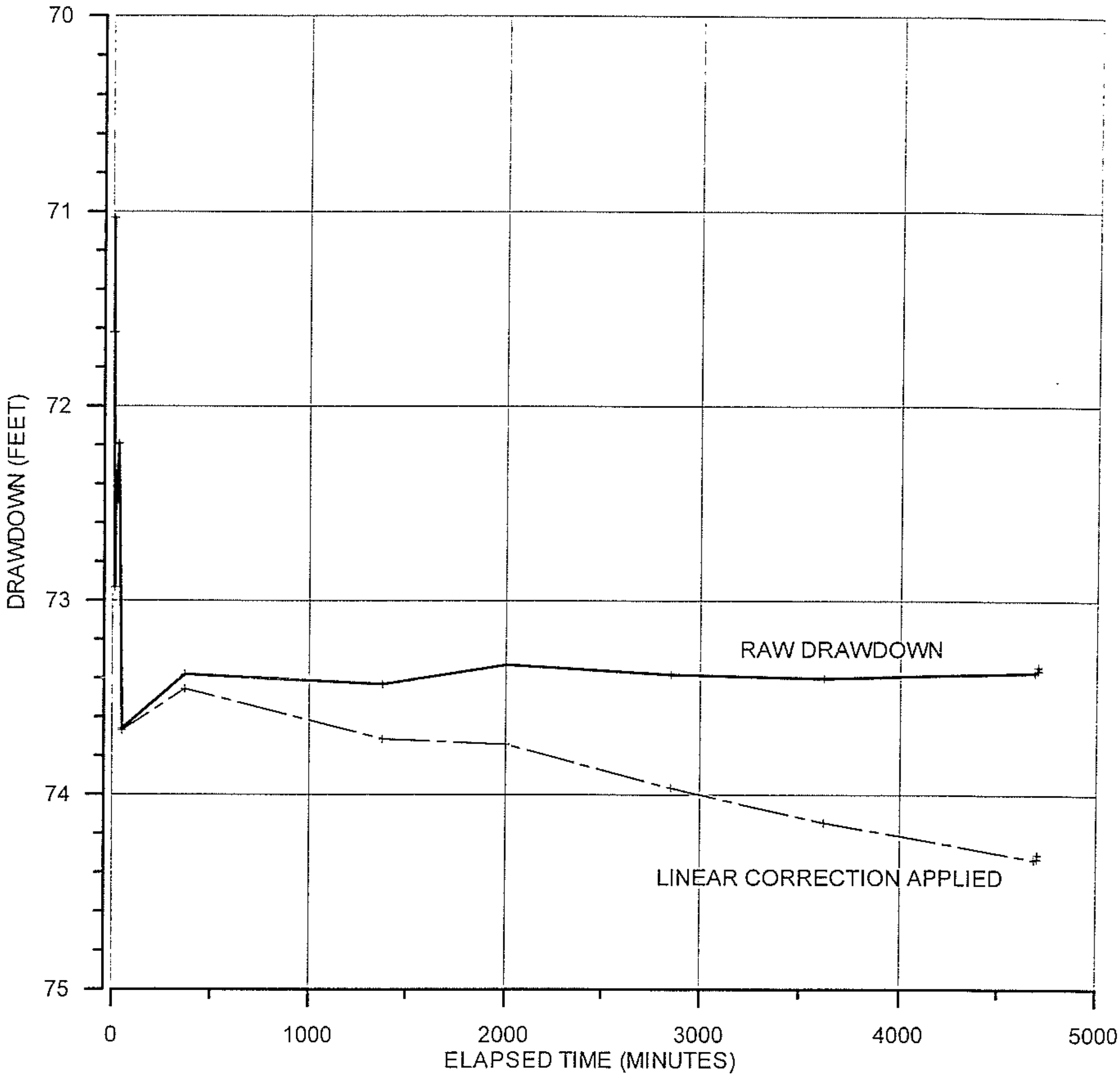
APPENDIX B

Aquifer Test Data

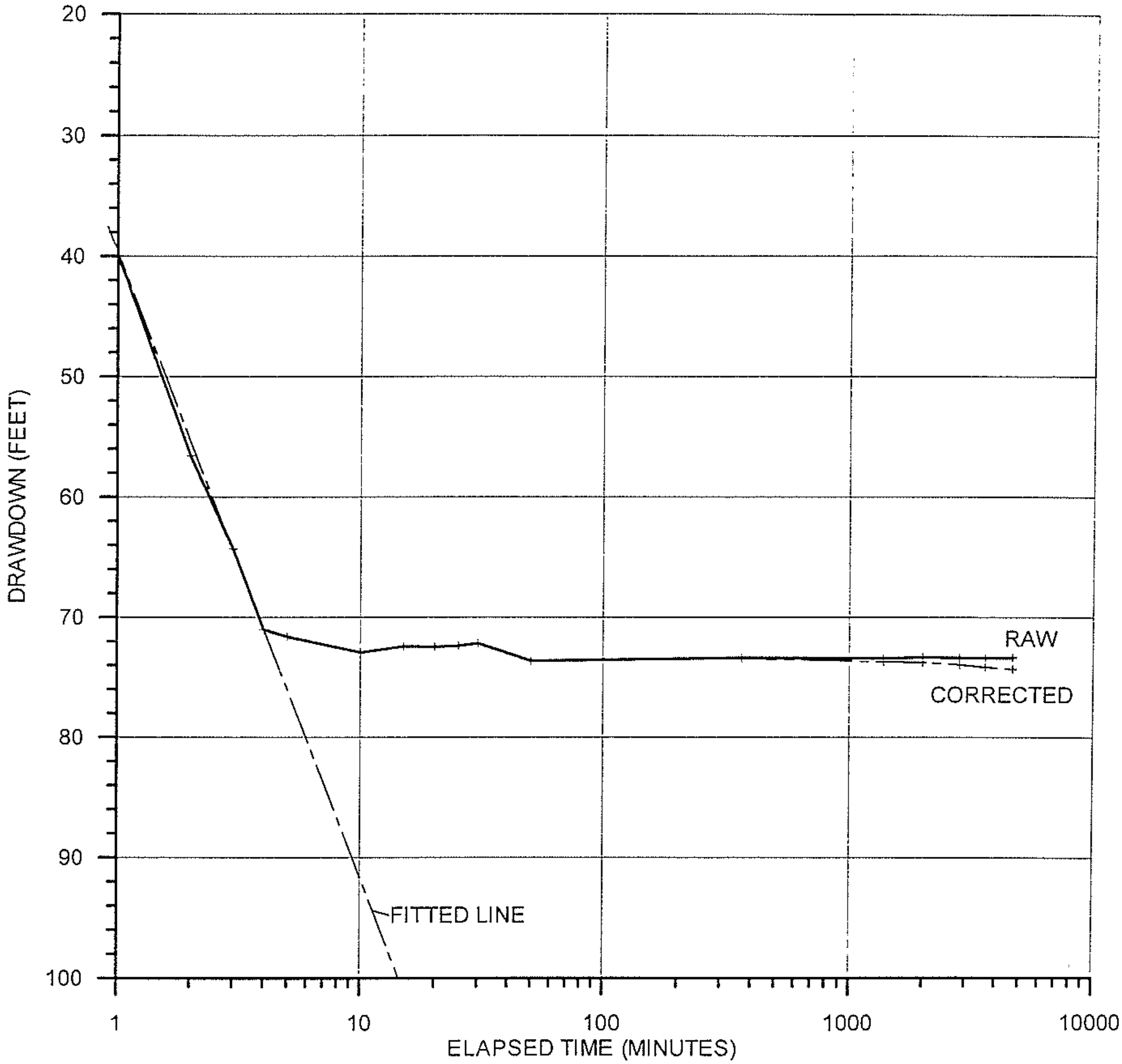


PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL STEP-RATE TEST
STEP 1
NOMINAL PUMPING RATE = 50 GPM
ACTUAL PUMPING RATE = 51.8 GPM
AVERAGE DRAWDOWN = 18.13 FT
SPECIFIC CAPACITY = 2.85 GPM/FT
STEP 2
NOMINAL PUMPING RATE = 100 GPM
ACTUAL PUMPING RATE = 101.3 GPM
AVERAGE DRAWDOWN = 39.34 FT
SPECIFIC CAPACITY = 2.57 GPM/FT
STEP 3
NOMINAL PUMPING RATE = 150 GPM
ACTUAL PUMPING RATE = 154.2 GPM
AVERAGE DRAWDOWN = 90.93 FT
SPECIFIC CAPACITY = 1.70 GPM/FT
DRAWDOWN
PUMPING RATE
DRAWDOWN (FEET)
PUMPING RATE (GPM)
ELAPSED TIME (MINUTES)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
200
180
160
140
120
100
80
60
40
20
0
0
30
60
90
120
150
180
210
240
270
300
330
360
390

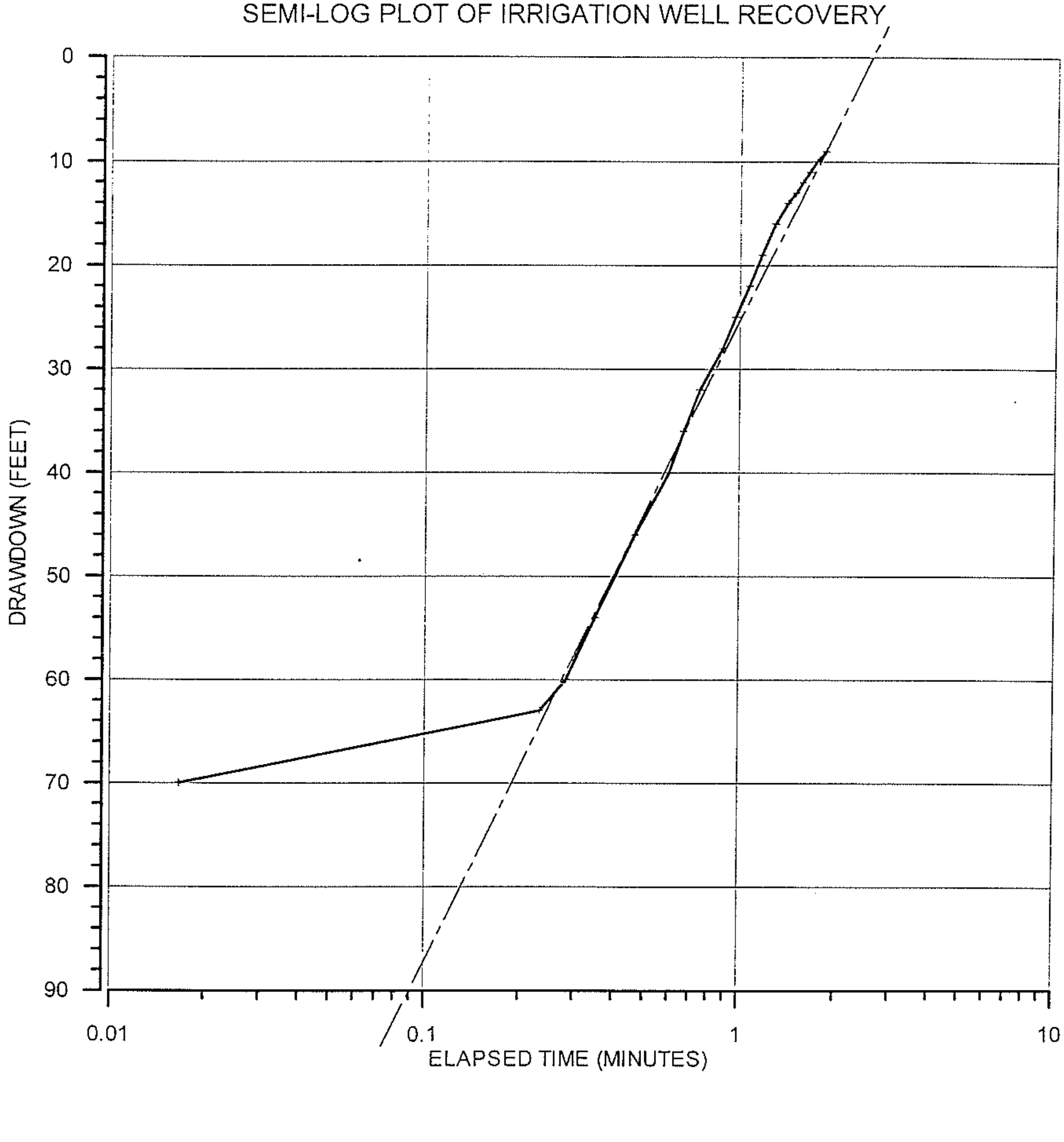
PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
ARITHMETIC PLOT OF IRRIGATION WELL DRAWDOWN



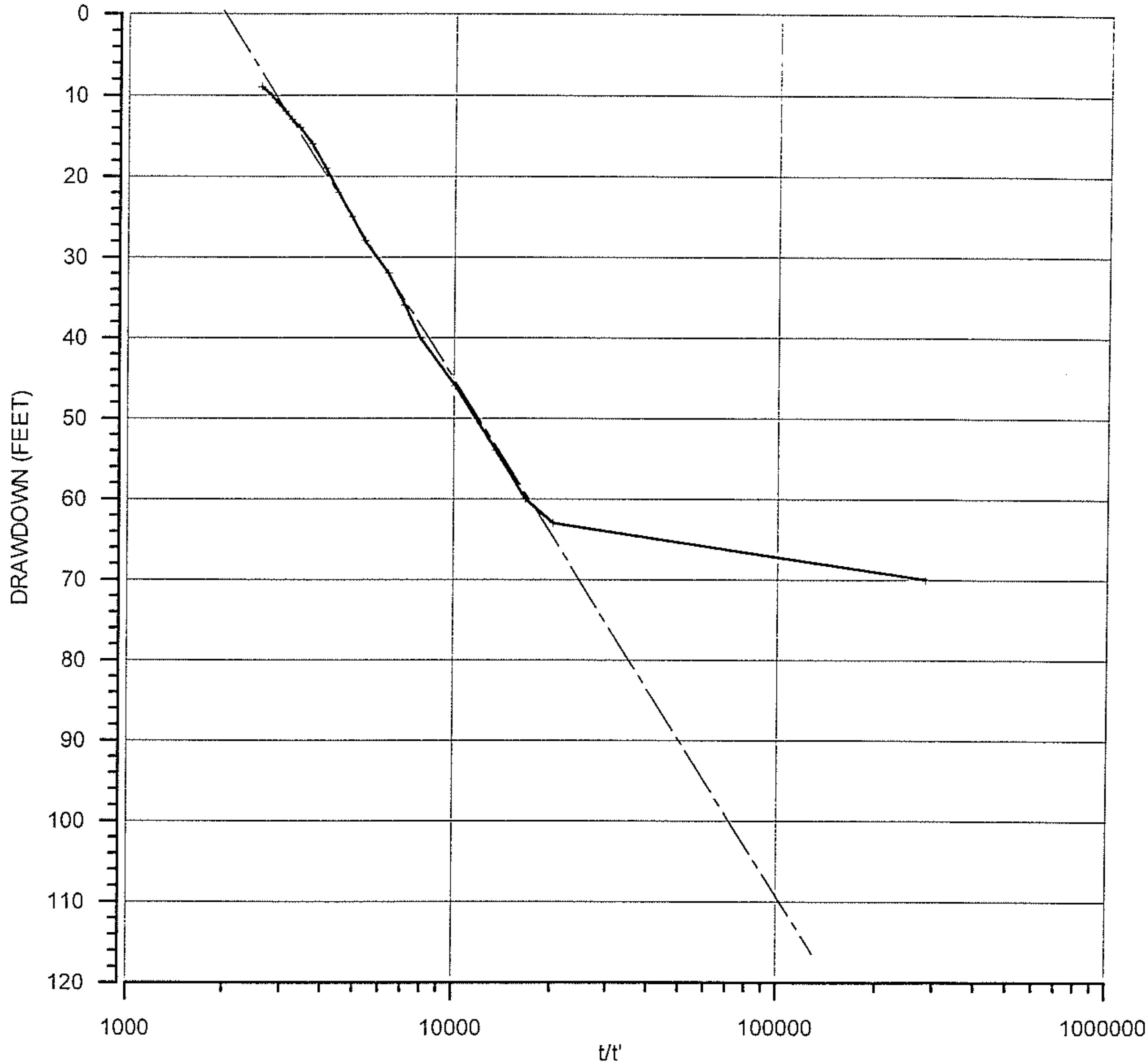
PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
SEMI-LOG PLOT OF IRRIGATION WELL DRAWDOWN

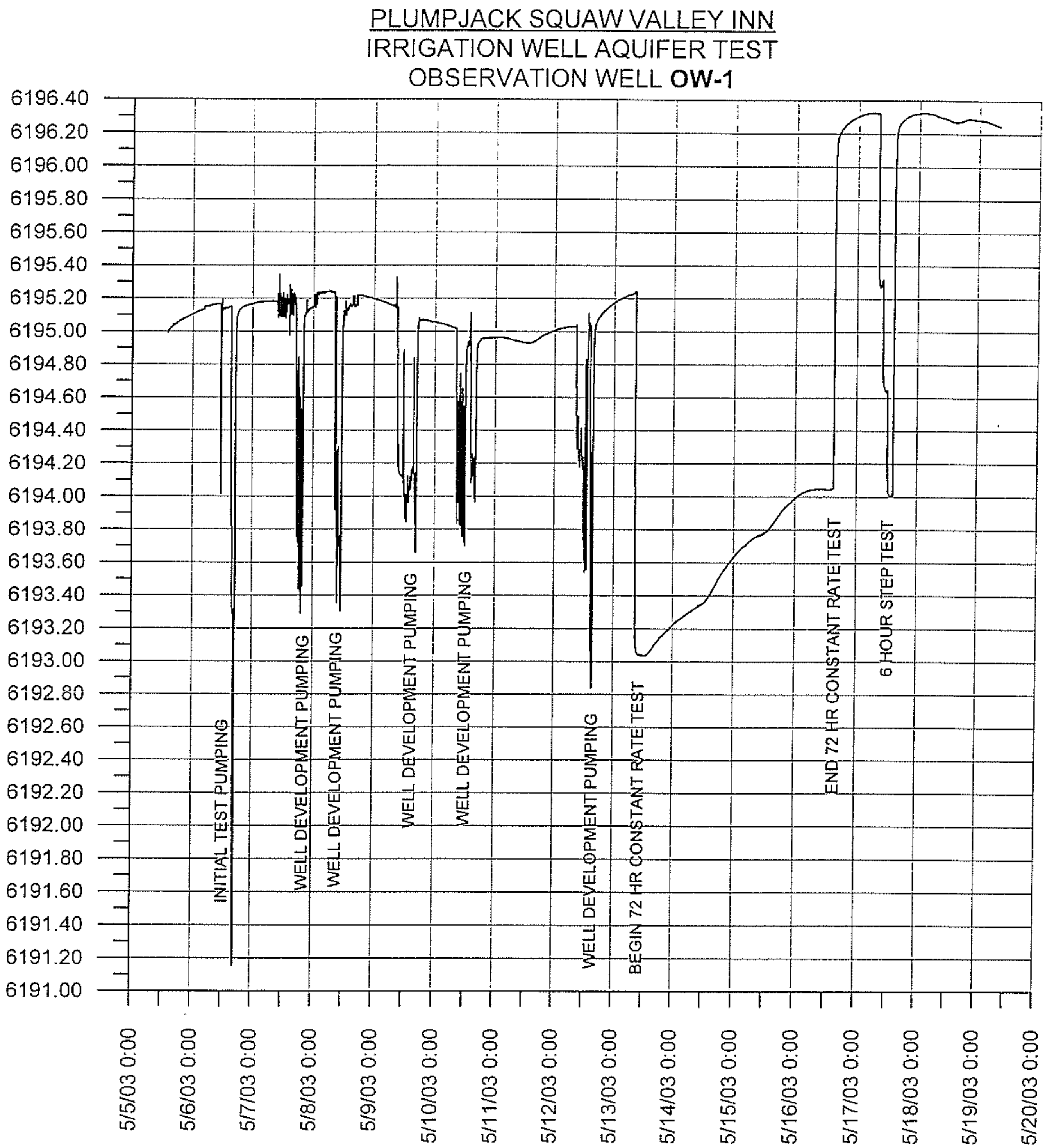


PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
SEMI-LOG PLOT OF IRRIGATION WELL RECOVERY



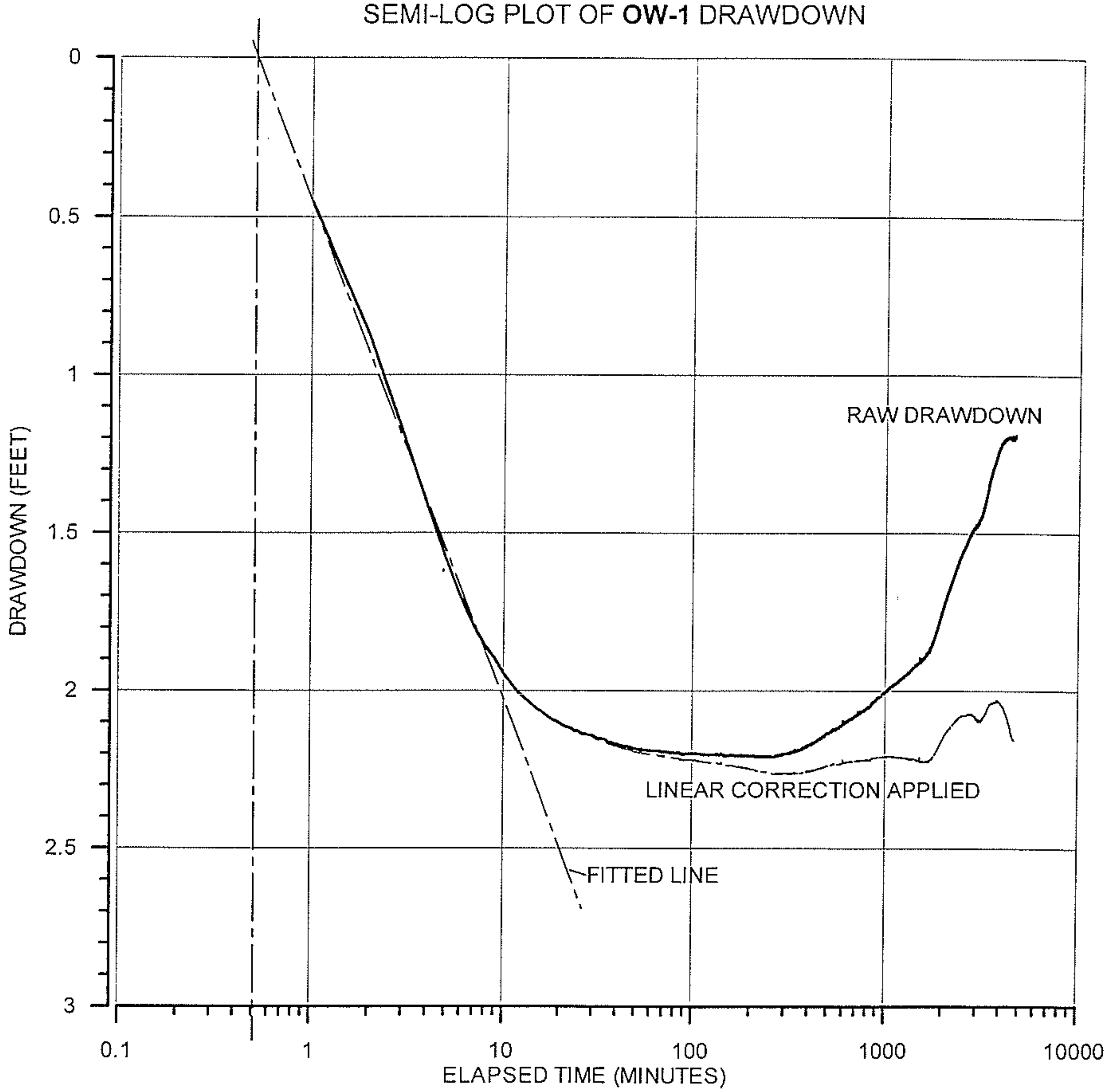
PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
SEMI-LOG PLOT OF IRRIGATION WELL RECOVERY



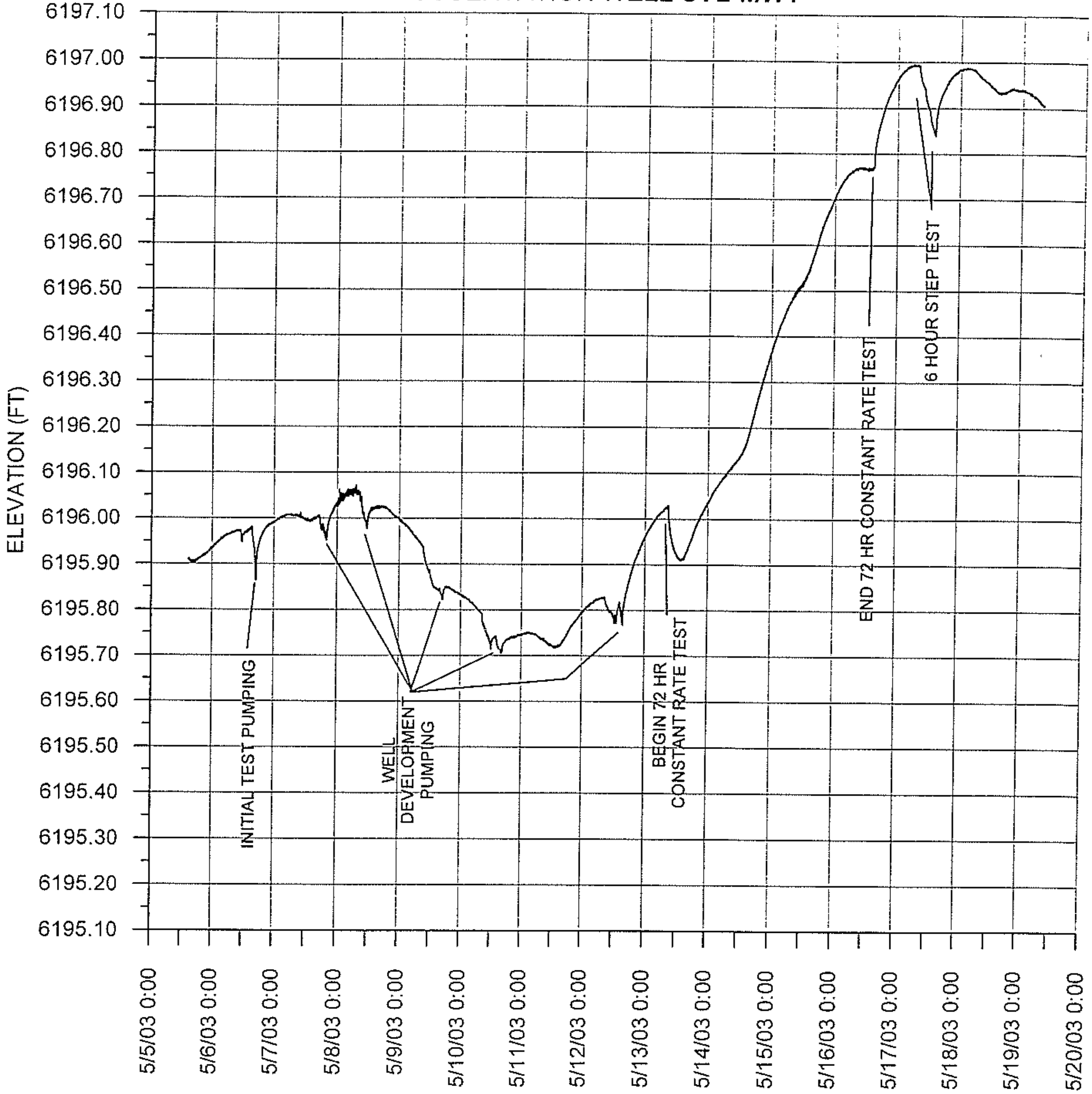


KLEINFELDER, INC. RENO, NEVADA 775-689-7800
(OW-1.GRF; B. PECK, 5/21/03)

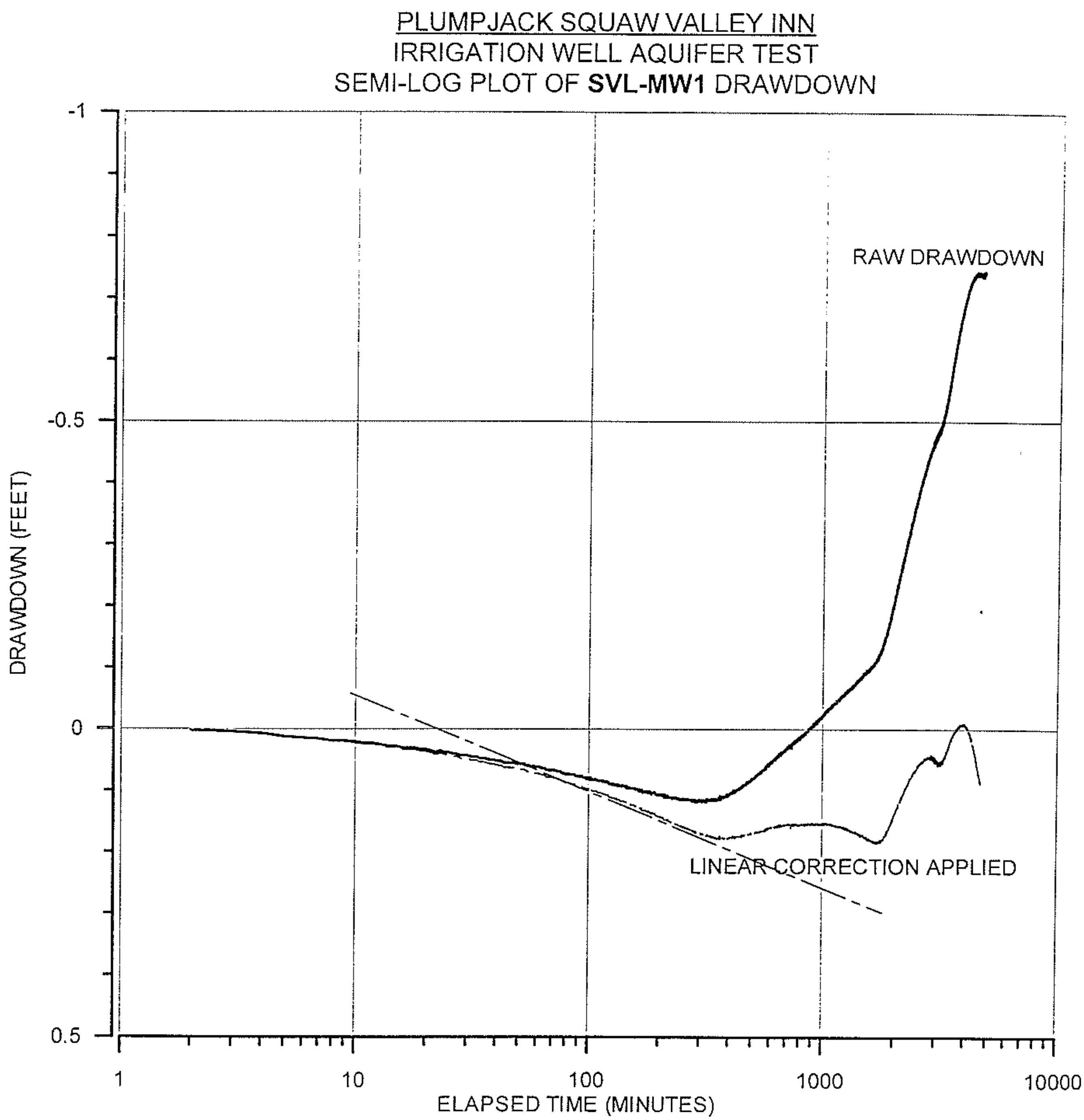
PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
SEMI-LOG PLOT OF **OW-1** DRAWDOWN



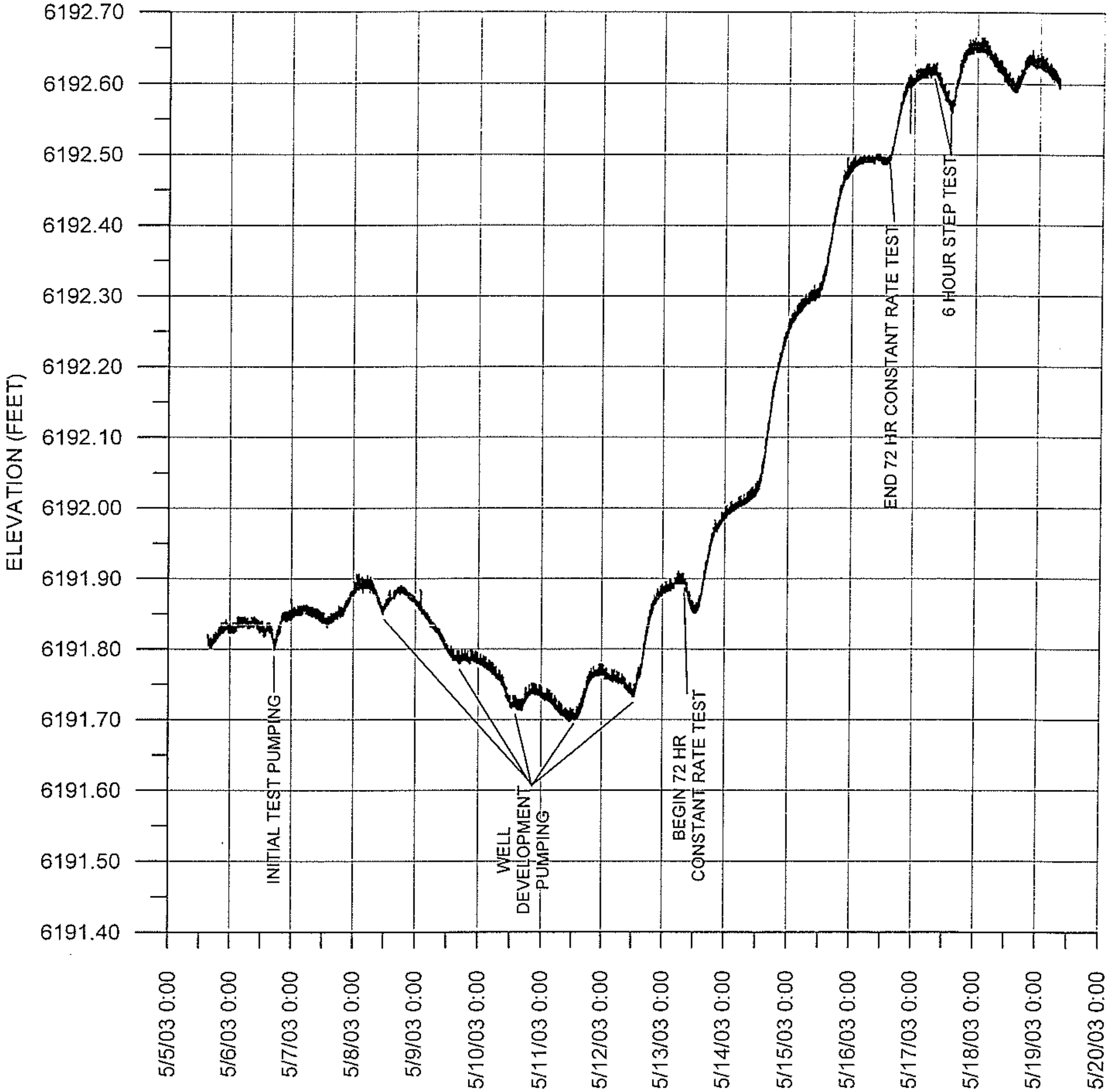
PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
OBSERVATION WELL **SVL-MW1**



KLEINFELDER, INC. RENO, NEVADA 775-689-7800
(SVLMW1.GRF; B. PECK, 5/20/03)

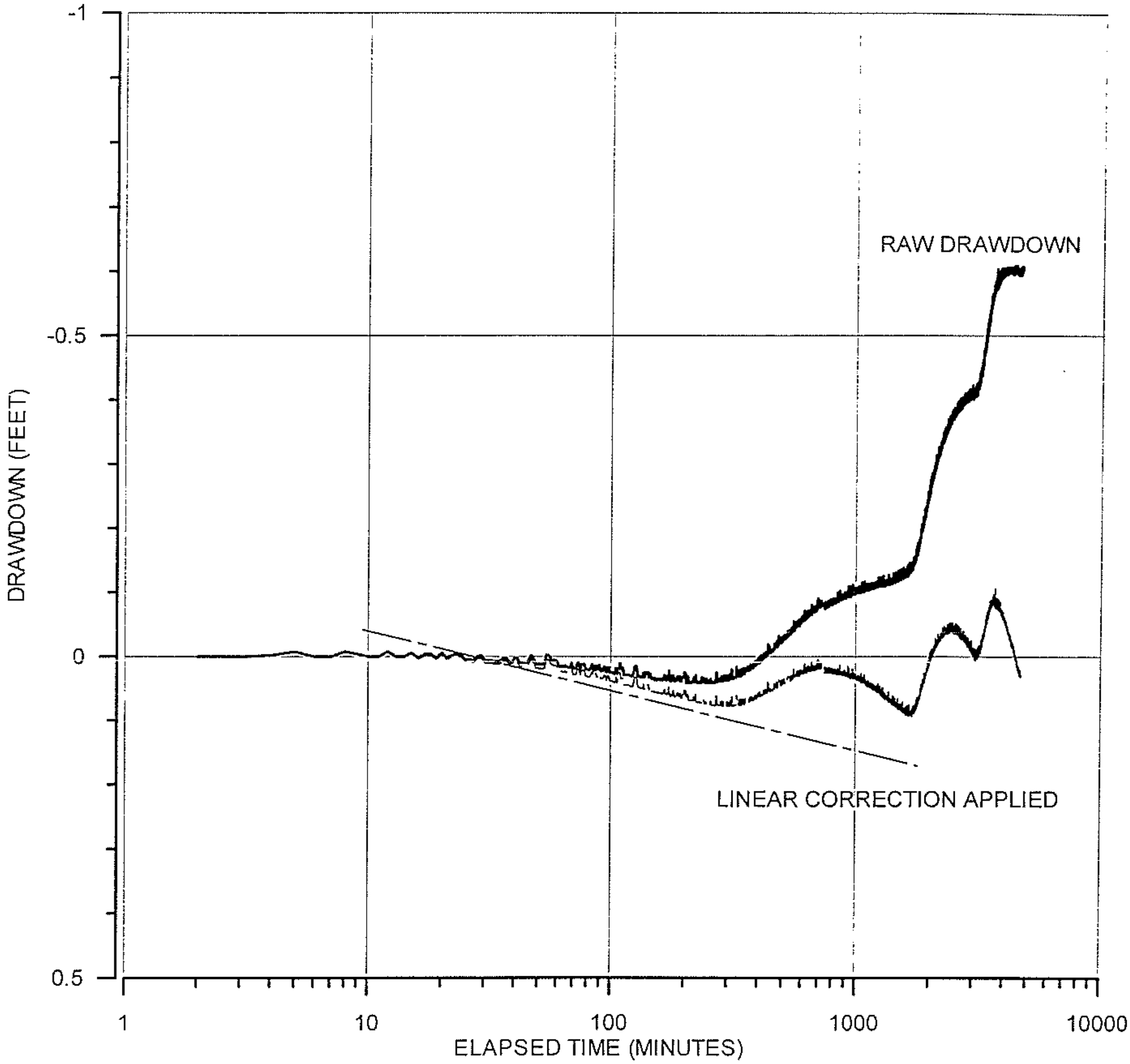

PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
SEMI-LOG PLOT OF SVL-MW1 DRAWDOWN
-1
-0.5
0
0.5
DRAWDOWN (FEET)
RAW DRAWDOWN
LINEAR CORRECTION APPLIED
1
10
100
1000
10000
ELAPSED TIME (MINUTES)

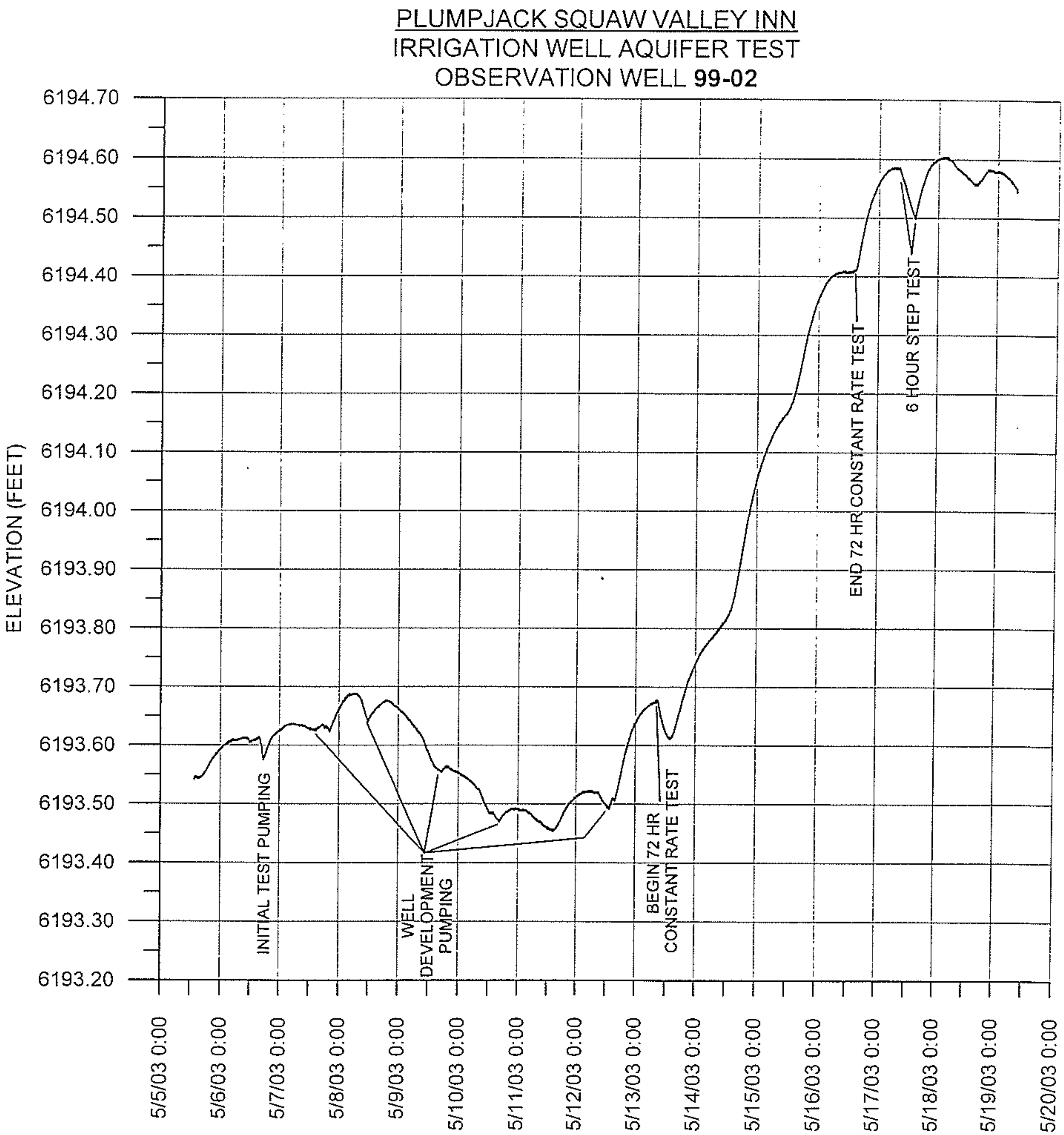
PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
OBSERVATION WELL 99-01



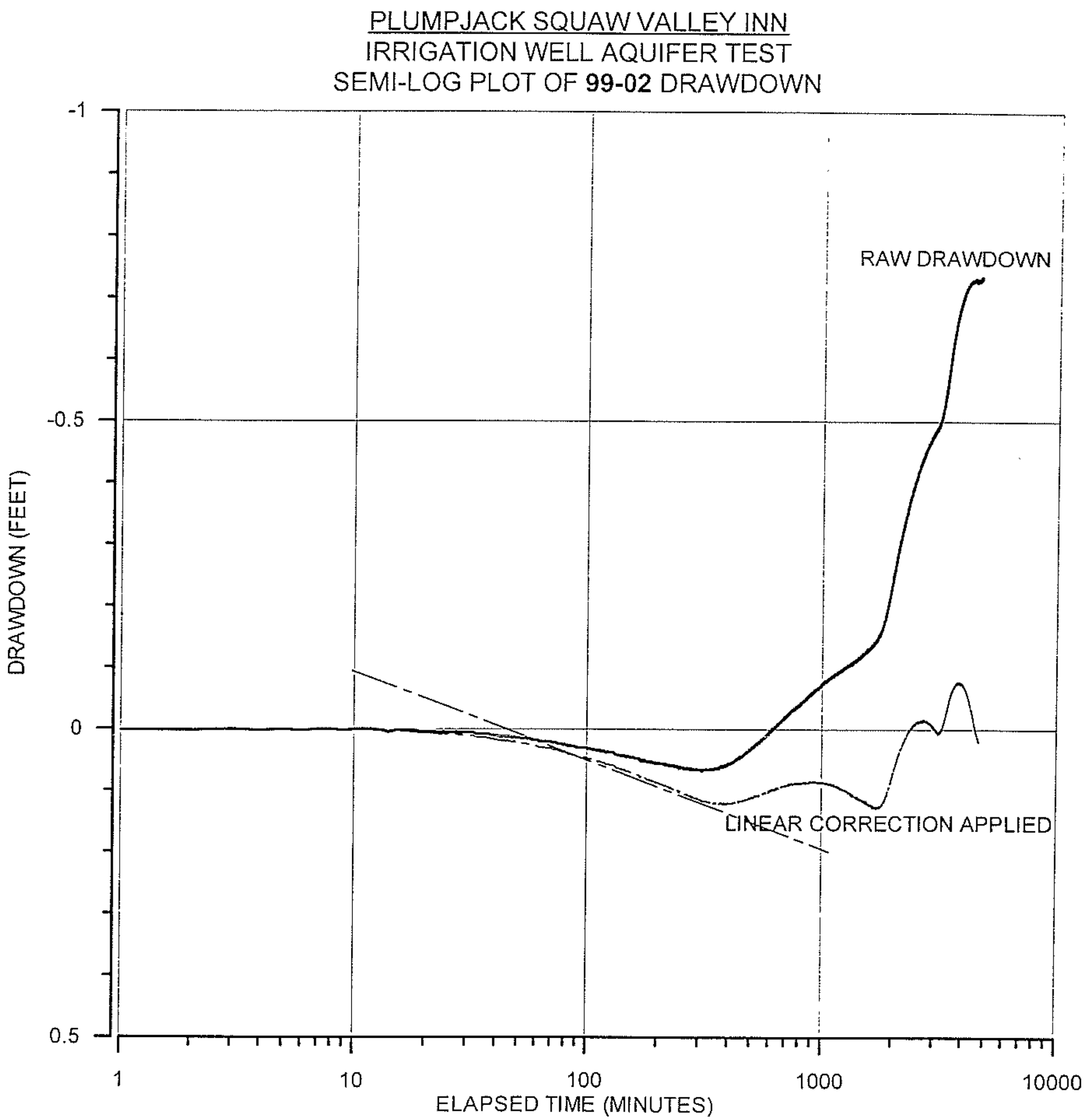
KLEINFELDER, INC. RENO, NEVADA 775-689-7800
(9901.GRF; B. PECK, 5/21/03)

PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
SEMI-LOG PLOT OF **99-01** DRAWDOWN

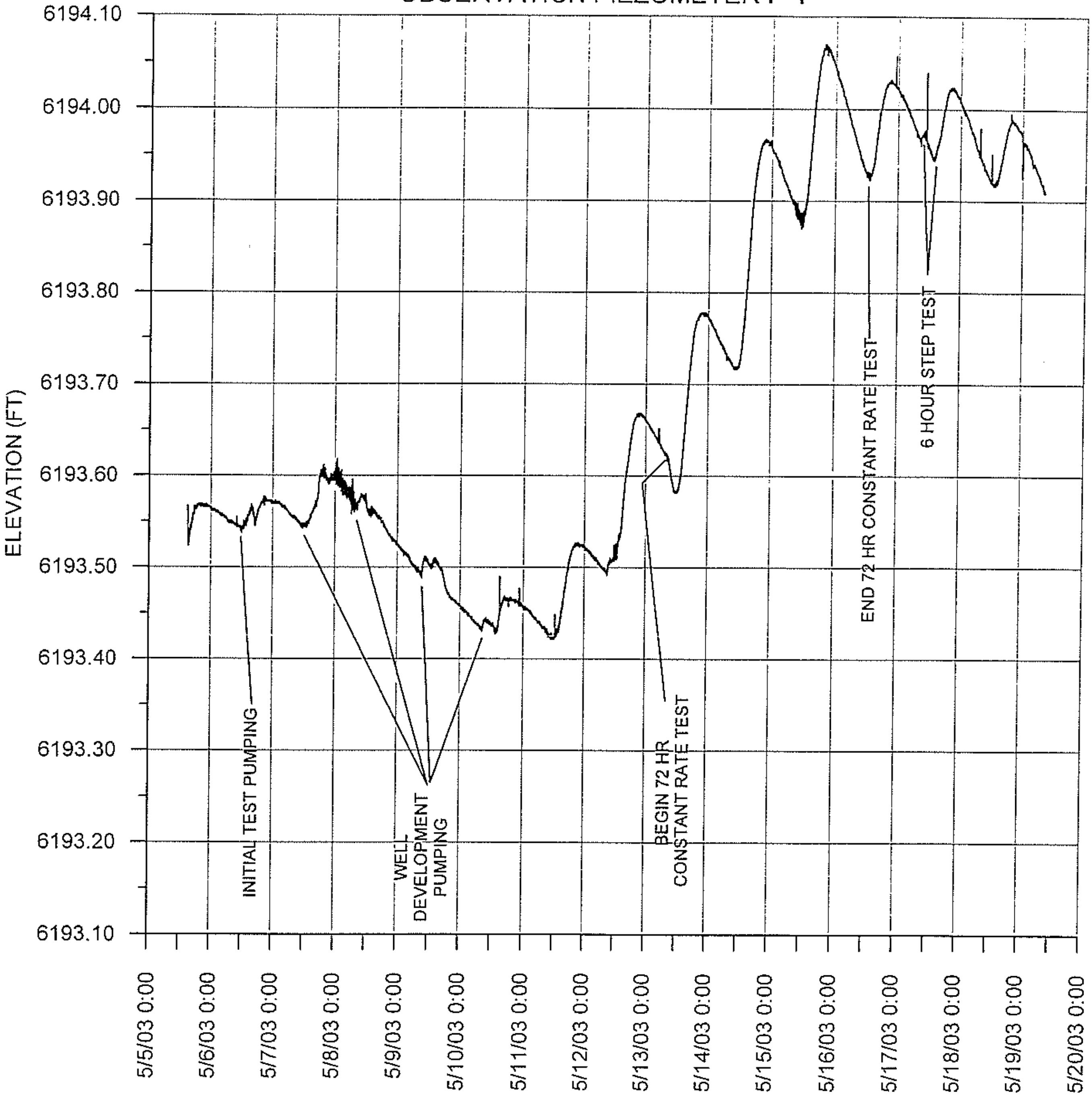




KLEINFELDER, INC. RENO, NEVADA 775-689-7800
(9902.GRF; B. PECK, 5/20/03)

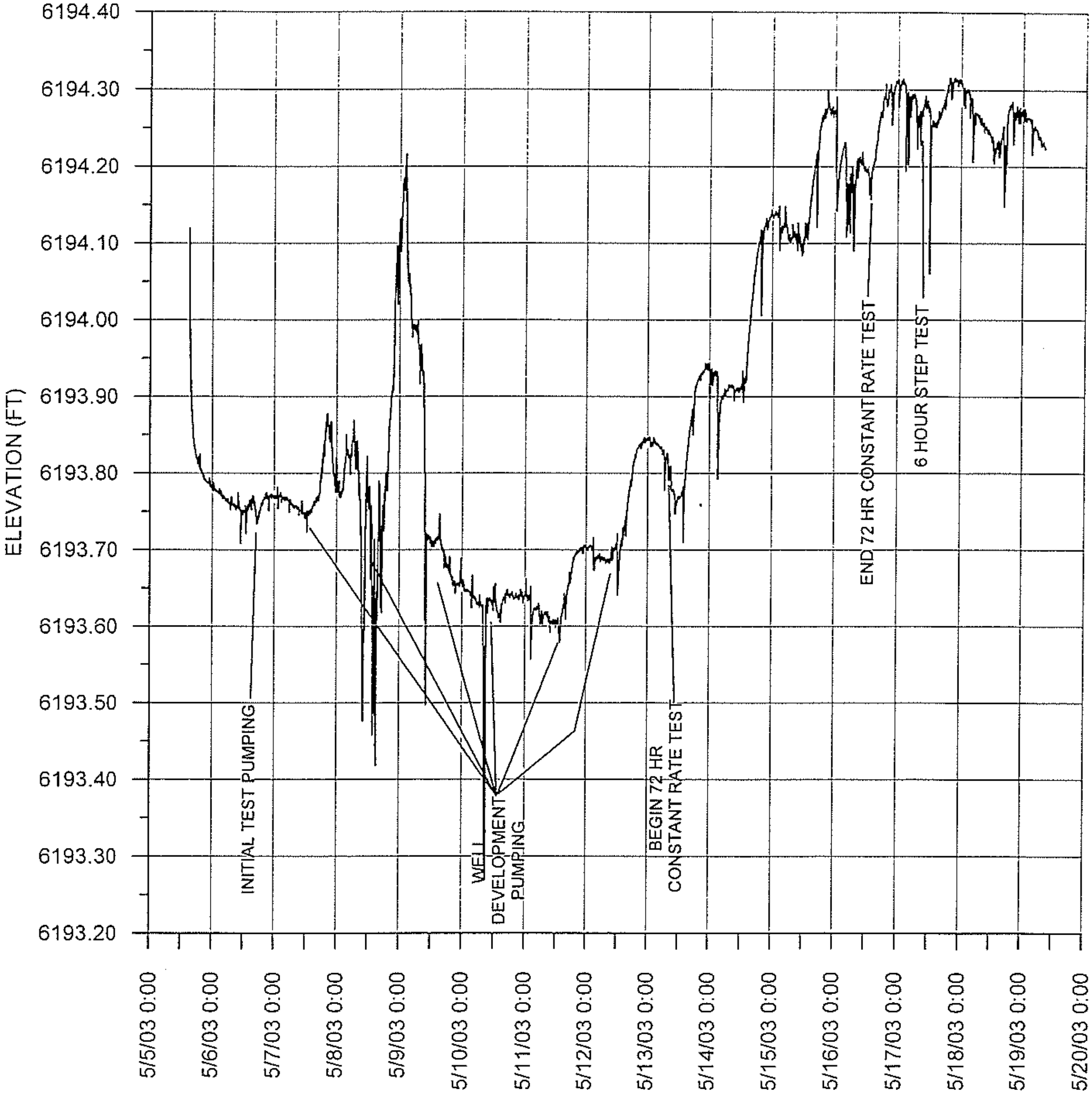

PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
SEMI-LOG PLOT OF 99-02 DRAWDOWN
-1
-0.5
0
0.5
DRAWDOWN (FEET)
RAW DRAWDOWN
LINEAR CORRECTION APPLIED
1
10
100
1000
10000
ELAPSED TIME (MINUTES)

PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
OBSERVATION PIEZOMETER **P-1**

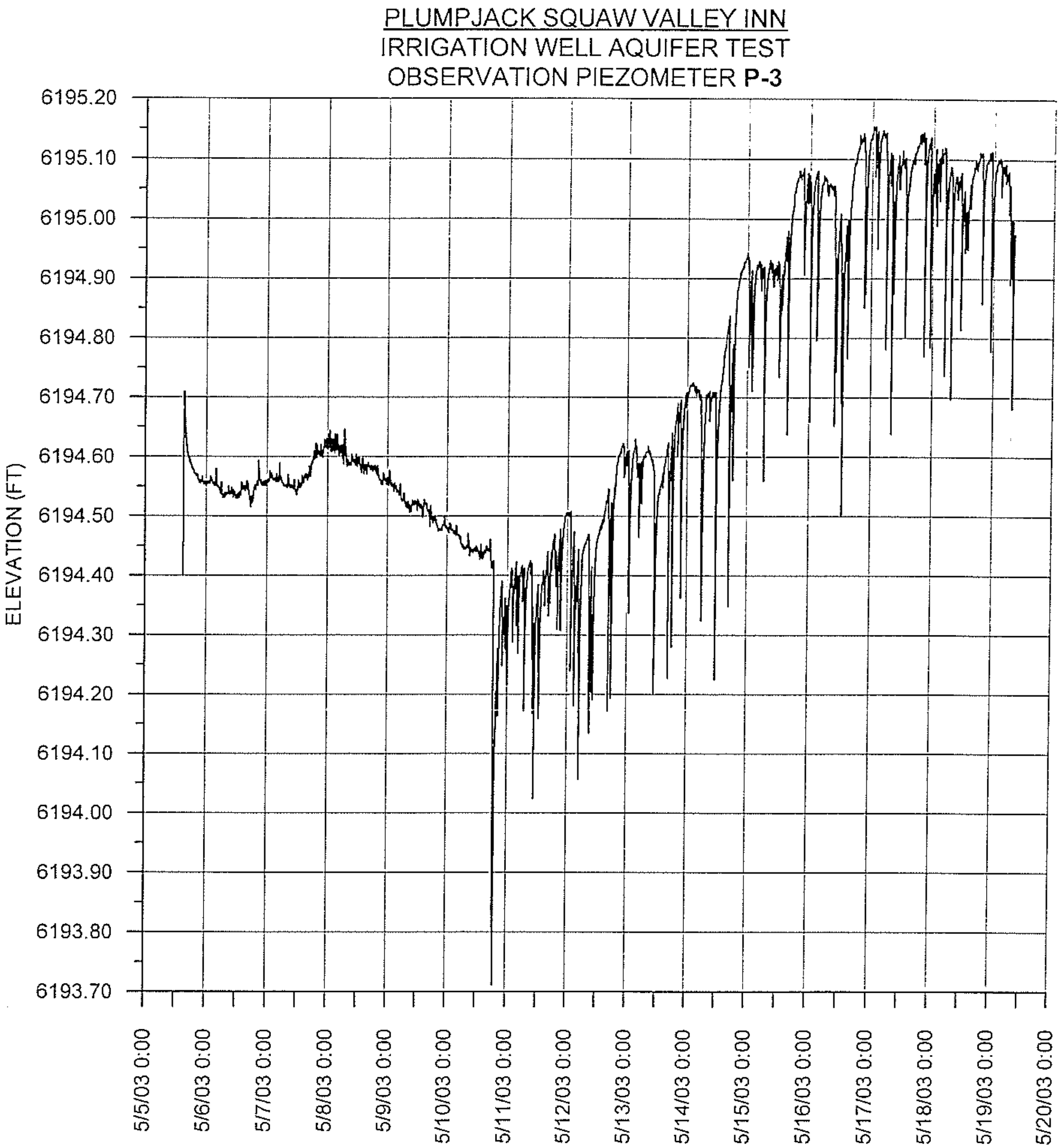


KLEINFELDER, INC. RENO, NEVADA 775-689-7800
(P1.GRF; B. PECK, 5/20/03)

PLUMPJACK SQUAW VALLEY INN
IRRIGATION WELL AQUIFER TEST
OBSERVATION PIEZOMETER **P-2**



KLEINFELDER, INC. RENO, NEVADA 775-689-7800
(P2.GRF; B. PECK, 5/20/03)



KLEINFELDER, INC. RENO, NEVADA 775-689-7800
(P3.GRF; B. PECK, 5/20/03)

APPENDIX C

Laboratory Analytical Reports

REC'D JUL 2 3 2003

WET LAB

Western Environmental Testing Laboratory

June 13, 2003

WET Lab ID No.: 305-036

Kleinfelder Inc.
4875 Longley Ln, #100
Reno, NV 89502
Attn: Dave Herzog

Dear Mr.Herzog,

This is to transmit the attached analytical report. The analytical data and information contained therein was generated using specified or selected methods contained in references, such as Standard Methods for the Examination of Water and Wastewater, 18th & 19th editions, Methods for Determination of Organic Compounds in Drinking Water, EPA-600/4-79-020, and Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods (SW846) Third Edition.

The samples were received by WET Lab. in good condition on 05/08/03.

The following selected correctness of analyses checks were performed per Standard Methods 1030 F. on samples designated "IW".

IW	TDS (meas)	TDS (calc)	EC	TDS (meas/calc)	TDS (calc)/EC	TDS (meas)/EC
5/6/03 1125	100	44.0	80	2.27	0.550	1.25
Criteria				**1 – 1.2**	**0.55 – 0.8**	**0.55 – 0.8**

If you should have any questions or comments regarding this report, please do not hesitate to call.

Sincerely,

Lance Bell

Lance Bell
Laboratory Manager
EPA Lab I.D. NV004

Enclosure

992 SPICE ISLANDS DRIVE, SPARKS, NEVADA 89431
TELEPHONE: 775-355-0202 FAX: 775-355-0817

WET LAB
Western Environmental Testing Laboratory

June 13, 2003

WET Lab ID No.: 305-066

Kleinfelder Inc.
1875 Longley Ln, #100
Reno, NV 89502
Attn: Dave Herzog

Dear Mr. Herzog,

This is to transmit the attached analytical report. The analytical data and information contained therein was generated using specified or selected methods contained in references, such as Standard Methods for the Examination of Water and Wastewater, 18th & 19th editions, Methods for Determination of Organic Compounds in Drinking Water, EPA-600/4-79-020, and Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods (SW846) Third Edition.

The samples were received by WET Lab. in good condition on 05/14/03.
The following selected correctness of analyses checks were performed per Standard Methods 1030 F. on samples designated "IW".

IW	TDS (meas)	TDS (calc)	EC	TDS (meas/calc)	TDS (calc)/EC	TDS (meas)/EC
5/13/03 2030	46	46.3	*	0.993	*	*
5/14/03 0800	54	46.3	*	1.17	*	*
Criteria				1 – 1.2	0.55 – 0.8	0.55 – 0.8

* - No data available for this analysis/calculation.

If you should have any questions or comments regarding this report, please do not hesitate to call.

Sincerely,

Lance Bell
Laboratory Manager
EPA Lab I.D. NV004

Enclosure

992 SPICE ISLANDS DRIVE, SPARKS, NEVADA 89431
TELEPHONE: 775-355-0202 FAX: 775-355-0817

WET LAB
Western Environmental Testing Laboratory

June 13, 2003

WET Lab ID No.: 305-083

Kleinfelder Inc.
1875 Longley Ln, #100
Reno, NV 89502
Attn: Dave Herzog

Dear Mr. Herzog,

This is to transmit the attached analytical report. The analytical data and information contained therein was generated using specified or selected methods contained in references, such as Standard Methods for the Examination of Water and Wastewater, 18th & 19th editions, Methods for Determination of Organic Compounds in Drinking Water, EPA-600/4-79-020, and Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods (SW846) Third Edition.

The samples were received by WET Lab. in good condition on 05/16/03.

The following selected correctness of analyses checks were performed per Standard Methods 1030 F. on samples designated "IW".

IW	TDS (meas)	TDS (calc)	EC	TDS (meas/calc)	TDS (calc)/EC	TDS (meas)/EC
5/14/03 2000	96	42.5	100	2.26	0.425	0.960
5/15/03 0800	96	47.3	100	2.03	0.473	0.960
5/15/03 2058	90	47.2	100	1.91	0.472	0.900
Criteria				**1 – 1.2**	**0.55 – 0.8**	**0.55 – 0.8**

If you should have any questions or comments regarding this report, please do not hesitate to call.

Sincerely,

Lance Bell

Lance Bell
Laboratory Manager
EPA Lab I.D. NV004
Enclosure

992 SPICE ISLANDS DRIVE, SPARKS, NEVADA 89431
TELEPHONE: 775-355-0202 FAX: 775-355-0817

WET LAB
Western Environmental Testing Laboratory

June 13, 2003

WET Lab ID No.: 305-087

Kleinfelder Inc.
1875 Longley Ln, #100
Reno, NV 89502
Attn: Dave Herzog

Dear Mr. Herzog,

This is to transmit the attached analytical report. The analytical data and information contained therein was generated using specified or selected methods contained in references, such as Standard Methods for the Examination of Water and Wastewater, 18th & 19th editions, Methods for Determination of Organic Compounds in Drinking Water, EPA-600/4-79-020, and Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods (SW846) Third Edition.

The samples were received by WET Lab. in good condition on 05/16/03.

The analysis for Purgeable/Extractable TPH by EPA Method 8015B was performed by Sierra Analytical Laboratory. Their report is attached.

The following selected correctness of analyses checks were performed per Standard Methods 1030 F. on samples designated "IW".

IW	TDS (meas)	TDS (calc)	EC	TDS (meas/calc)	TDS (calc)/EC	TDS (meas)/EC
5/16/03 0900	99	41.2	80	2.40	0.515	1.23
Criteria				**1 – 1.2**	**0.55 – 0.8**	**0.55 – 0.8**

If you should have any questions or comments regarding this report, please do not hesitate to call.

Sincerely,

Lance Bell
Laboratory Manager
EPA Lab I.D. NV004
Enclosure

992 SPICE ISLANDS DRIVE, SPARKS, NEVADA 89431
TELEPHONE: 775-355-0202 FAX: 775-355-0817

WET LAB
Western Environmental Testing Laboratory

May 21, 2003

WET Lab ID No.: 305-036

Kleinfelder Inc.
4875 Longley Ln, #100
Reno, NV 89502
Attn: Dave Herzog

Dear Mr.Herzog,

This is to transmit the attached analytical report. The analytical data and information contained therein was generated using specified or selected methods contained in references, such as Standard Methods for the Examination of Water and Wastewater, 18th & 19th editions, Methods for Determination of Organic Compounds in Drinking Water, EPA-600/4-79-020, and Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods (SW846) Third Edition.

The samples were received by WET Lab. in good condition on 05/08/03.

If you should have any questions or comments regarding this report, please do not hesitate to call.

Sincerely,

Lance Bell

Lance Bell
Laboratory Manager
EPA Lab I.D. NV004

Enclosure

992 SPICE ISLANDS DRIVE, SPARKS, NEVADA 89431
TELEPHONE: 775-355-0202 FAX: 775-355-0817

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder
4875 Longley Lane, Suite 100
Reno, NV 89502
Attn: Dave Herzog

Phone: 689-7800 Fax: 689-7810

ELAP No: 2523
Received: 05/08/03
Lab Sample ID: 305-036 01-02
Reported: 05/28/03

Project Name/Number: Plumpjack/22705
Sample ID: see below
Date/ Time Collected: 05/06/03 @ 1125
Sampled By: Client

Parameter	Method	Results	Units	Analyzed
IW				
Nitrate Nitrogen	300.0	<0.010	mg/L	05/08/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/08/03
Total Kjeldahl Nitrogen	351.3	0.11	mg/L	05/12/03
Total Nitrogen	calc.	0.11	mg/L	05/12/03
Total Phosphorus	365.3	0.0082	mg/L	05/14/03
Turbidity	180.1	0.28	NTU	05/08/03
Total Dissolved Solids	2540C	100	mg/L	05/09/03
pH	150.1	5.55	SU	05/08/03
Iron	200.7	<0.010	mg/L	05/19/03
Electrical Conductivity	2510B	80	uS/cm	05/28/03
SQ #1				
Nitrate Nitrogen	300.0	0.17	mg/L	05/08/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/08/03
Total Kjeldahl Nitrogen	351.3	0.092	mg/L	05/12/03
Total Nitrogen	calc.	0.26	mg/L	05/12/03
Total Phosphorus	365.3	<0.0050	mg/L	05/14/03
Turbidity	180.1	0.81	NTU	05/08/03
Total Dissolved Solids	2540C	85	mg/L	05/09/03
pH	150.1	6.55	SU	05/08/03
Iron	200.7	<0.010	mg/L	05/19/03
Electrical Conductivity	2510B	50	uS/cm	05/28/03

Lance Bell, Lab Manger

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder
4875 Longley Lane, Suite 100
Reno, NV 89502
Attn: Dave Herzog

ELAP No: 2523
Received: 05/08/03
Lab Sample ID: 305-036 03
Reported: 05/28/03

Phone: 689-7800 Fax: 689-7810

Project Name/Number:	Plumpjack/22705
Sample ID:	see below
Date/ Time Collected:	05/06/03 @ 1145
Sampled By:	Client

Parameter	Method	Results	Units	Analyzed
SQ #2				
Nitrate Nitrogen	300.0	0.13	mg/L	05/08/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/08/03
Total Kjeldahl Nitrogen	351.3	0.069	mg/L	05/12/03
Total Nitrogen	calc.	0.20	mg/L	05/12/03
Total Phosphorus	365.3	0.0085	mg/L	05/14/03
Turbidity	180.1	0.58	NTU	05/08/03
Total Dissolved Solids	2540C	79	mg/L	05/09/03
pH	150.1	6.33	SU	05/08/03
Iron	200.7	<0.010	mg/L	05/20/03
Electrical Conductivity	2510B	50	uS/cm	05/28/03

Lance Bell, Lab Manger

WET LAB

Western Environmental Testing Laboratory

992 SPICE ISLANDS DRIVE, SPARKS, NEVADA 89431 TEL. 775-355-0202 FAX. 775-355-0817

Lab Number: 305-036

Report Due Date:

Client: KLI		Fax Results (Y) N	Page of
Address		PUBLIC WATER SUPPLY INFORMATION	
City, State & Zip		System Name	
Contact: D Herzog		PWS No.	Report to State/EPA Y N
Phone: 6397300	Collector's Name: D Herzog	POE No.	DWR No.
Fax: 6397610	Project Name: Plumjack	Collection Point	
P.O. Number	Project Number: 7-2725-10	City	County

SAMPLE TYPE CODES

DW = drinking water TB = travel blank
WW = waste water SD = solid
MW = monitoring well SO = soil
HW = hazardous waste SL = sludge

Compliance Monitoring (Y) N

TURNAROUND TIME REQUESTED

Standard
RUSH
Special

Lab Manager Approval

Analyses Requested: Metals; Total N; Nitrate; Total P; Nitrite; [illegible]; [illegible]; TDS; TSS; Total Fe; pH

CLIENT'S SAMPLE ID/LOCATION	Date	Time	Sample Type	Containers	Metals	Total N	Nitrate	Total P	[illegible]	[illegible]	[illegible]	TDS	TSS	Total Fe	pH	Spl. No.
IW / + RUSH NO3 only	5/6/03	1125		2L	X	X	X	X	X	X	X					1
SW#1	5/6/03	[illegible]		2L	X	X	X	X	X	X	X					2
SW#2	5/6/03	1105		2L	X	X	X	X	X	X	X					3

Instructions/Comments/Special Requirements:

SAMPLE RECEIPT			Date	Time	Samples Relinquished By	Samples Received By
Received Cold	Y	N			D Herzog	
Custody Seals	Y	N	5-8-03	10:..		M. Kramer - void
Seals Intact	Y	N				Unpres
No. of Containers						

WET Lab's Standard Terms and Conditions apply unless written agreements specify otherwise. Payment terms are Net 30.

WET LAB

Western Environmental Testing Laboratory

June 13, 2003

WET Lab ID No.: 305-066

Kleinfelder Inc.
1875 Longley Ln, #100
Reno, NV 89502
Attn: Dave Herzog

Dear Mr. Herzog,

This is to transmit the attached analytical report. The analytical data and information contained therein was generated using specified or selected methods contained in references, such as Standard Methods for the Examination of Water and Wastewater, 18th & 19th editions, Methods for Determination of Organic Compounds in Drinking Water, EPA-600/4-79-020, and Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods (SW846) Third Edition.

The samples were received by WET Lab. in good condition on 05/14/03.

If you should have any questions or comments regarding this report, please do not hesitate to call.

Sincerely,

Lance Bell
Laboratory Manager
EPA Lab I.D. NV004

Enclosure

992 SPICE ISLANDS DRIVE, SPARKS, NEVADA 89431
TELEPHONE: 775-355-0202 FAX: 775-355-0817

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder
4875 Longley Lane, Suite 100
Reno, NV 89502
Attn: Dave Herzog

ELAP No: 2523
Received: 05/14/03
Lab Sample ID: 305-066 01-02
Reported: 05/28/03

Phone: 689-7800 Fax: 689-7810

Project Name/Number: Plumpjack/22705
Sample ID: see below
Date/ Time Collected: 05/13/03 @ 2030 & 2035
Sampled By: Client

Parameter	Method	Results	Units	Analyzed
IW				
Nitrate Nitrogen	300.0	<0.010	mg/L	05/14/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/14/03
Total Kjeldahl Nitrogen	351.3	0.093	mg/L	05/26/03
Total Nitrogen	calc.	0.093	mg/L	05/26/03
Total Phosphorus	365.3	0.0051	mg/L	05/22/03
Turbidity	180.1	0.61	NTU	05/24/03
Total Dissolved Solids	2540C	46	mg/L	05/14/03
pH	150.1	5.05	SU	05/24/03
Iron	200.7	0.030	mg/L	05/20/03
SQ #1				
Nitrate Nitrogen	300.0	0.16	mg/L	05/14/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/14/03
Total Kjeldahl Nitrogen	351.3	0.10	mg/L	05/26/03
Total Nitrogen	calc.	0.26	mg/L	05/26/03
Total Phosphorus	365.3	0.011	mg/L	05/22/03
Turbidity	180.1	1.4	NTU	05/24/03
Total Dissolved Solids	2540C	17	mg/L	05/14/03
pH	150.1	6.69	SU	05/24/03
Iron	200.7	0.065	mg/L	05/20/03

Lance Bell, Lab Manger

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder
4875 Longley Lane, Suite 100
Reno, NV 89502
Attn: Dave Herzog

Phone: 689-7800 Fax: 689-7810

ELAP No: 2523
Received: 05/14/03
Lab Sample ID: 305-066 03-04
Reported: 05/28/03

Project Name/Number: Plumpjack/22705
Sample ID: see below
Date/ Time Collected: 05/13/03 @ 2040 & 05/14/03 @ 0800
Sampled By: Client

Parameter	Method	Results	Units	Analyzed
SQ #2				
Nitrate Nitrogen	300.0	0.13	mg/L	05/14/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/14/03
Total Kjeldahl Nitrogen	351.3	0.091	mg/L	05/26/03
Total Nitrogen	calc.	0.21	mg/L	05/26/03
Total Phosphorus	365.3	0.019	mg/L	05/22/03
Turbidity	180.1	1.1	NTU	05/24/03
Total Dissolved Solids	2540C	35	mg/L	05/14/03
pH	150.1	6.59	SU	05/24/03
Iron	200.7	0.071	mg/L	05/20/03
IW				
Nitrate Nitrogen	300.0	<0.010	mg/L	05/14/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/14/03
Total Kjeldahl Nitrogen	351.3	0.070	mg/L	05/26/03
Total Nitrogen	calc.	0.070	mg/L	05/26/03
Total Phosphorus	365.3	0.0065	mg/L	05/22/03
Turbidity	180.1	0.40	NTU	05/24/03
Total Dissolved Solids	2540C	54	mg/L	05/14/03
pH	150.1	5.18	SU	05/24/03
Iron	200.7	<0.020	mg/L	05/21/03

Lance Bell, Lab Manger

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder
4875 Longley Lane, Suite 100
Reno, NV 89502
Attn: Dave Herzog

ELAP No: 2523
Received: 05/14/03
Lab Sample ID: 305-066 05-06
Reported: 05/28/03

Phone: 689-7800 Fax: 689-7810

Project Name/Number: Plumpjack/22705
Sample ID: see below
Date/ Time Collected: 05/14/03 @ 0810 & 0815
Sampled By: Client

Parameter	Method	Results	Units	Analyzed
SQ #1				
Nitrate Nitrogen	300.0	0.20	mg/L	05/14/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/14/03
Total Kjeldahl Nitrogen	351.3	0.074	mg/L	05/26/03
Total Nitrogen	calc.	0.27	mg/L	05/26/03
Total Phosphorus	365.3	0.0071	mg/L	05/22/03
Turbidity	180.1	1.1	NTU	05/24/03
Total Dissolved Solids	2540C	31	mg/L	05/14/03
pH	150.1	6.69	SU	05/24/03
Iron	200.7	0.042	mg/L	05/20/03
SQ #2				
Nitrate Nitrogen	300.0	0.16	mg/L	05/14/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/14/03
Total Kjeldahl Nitrogen	351.3	0.074	mg/L	05/26/03
Total Nitrogen	calc.	0.23	mg/L	05/26/03
Total Phosphorus	365.3	0.0087	mg/L	05/22/03
Turbidity	180.1	0.89	NTU	05/24/03
Total Dissolved Solids	2540C	35	mg/L	05/14/03
pH	150.1	6.58	SU	05/24/03
Iron	200.7	0.036	mg/L	05/20/03

Lance Bell, Lab Manger

WET LAB

Western Environmental Testing Laboratory

992 SPICE ISLANDS DRIVE, SPARKS, NEVADA 89431 TEL. 775-355-0202 FAX. 775-355-0817

Lab Number 305-066

Report Due Date: 5-26-03

Client KLEINFELDER		Fax Results Y (N)	Page of
Address		**PUBLIC WATER SUPPLY INFORMATION**	
City, State & Zip		System Name	
Contact		PWS No.	Report to State/EPA Y N
Phone	Collector's Name	POE No.	DWR No.
Fax	Project Name	Collection Point	
P.O. Number	Project Number 77725.03	City	County

SAMPLE TYPE CODES

DW = drinking water TB = travel blank
WW = waste water SD = solid
MW = monitoring well SO = soil
HW = hazardous waste SL = sludge

Compliance Monitoring (Y) N

TURNAROUND TIME REQUESTED

Standard X
RUSH
Special

Lab Manager Approval

Analyses Requested: Total Nitrogen, Nitrate, Total Phosphorous, TDS, Total Iron, Turbidity (Hold), pH (Hold)

CLIENT'S SAMPLE ID/LOCATION	Date	Time	Sample Type	Containers	Total Nitrogen	Nitrate	Total Phosphorous	TDS	Total Iron	Turbidity (Hold)	pH (Hold)					Spl. No.
IW	5/13	2020	WW	3	X	X	X	X	X	X	X					1
SQ #1	5/13	2035	WW	3	X	X	X	X	X	X	X					2
SQ #2	5/13	2040	WW	3	X	X	X	X	X	X	X					3
IW	5/14	0800	WW	3	X	X	X	X	X	X	X					4
SQ #1	5/14	0810	WW	3	X	X	X	X	X	X	X					5
SQ #2	5/14	0815	WW	3	X	X	X	X	X	X	X					6

Instructions/Comments/Special Requirements:

SAMPLE RECEIPT	Date	Time	Samples Relinquished By	Samples Received By
Received Cold (Y) N 9.5	5/14	920	[signature]	[signature]
Custody Seals Y N				
Seals Intact Y N				
No. of Containers 18				

WET Lab's Standard Terms and Conditions apply unless written agreements specify otherwise. Payment terms are Net 30.

WET LAB
Western Environmental Testing Laboratory

June 13, 2003

WET Lab ID No.: 305-083

Kleinfelder Inc.
1875 Longley Ln, #100
Reno, NV 89502
Attn: Dave Herzog

Dear Mr. Herzog,

This is to transmit the attached analytical report. The analytical data and information contained therein was generated using specified or selected methods contained in references, such as Standard Methods for the Examination of Water and Wastewater, 18th & 19th editions, Methods for Determination of Organic Compounds in Drinking Water, EPA-600/4-79-020, and Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods (SW846) Third Edition.

The samples were received by WET Lab. in good condition on 05/16/03.

If you should have any questions or comments regarding this report, please do not hesitate to call.

Sincerely,

Lance Bell
Laboratory Manager
EPA Lab I.D. NV004

Enclosure

992 SPICE ISLANDS DRIVE, SPARKS, NEVADA 89431
TELEPHONE: 775-355-0202 FAX: 775-355-0817

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder
4875 Longley Lane, Suite 100
Reno, NV 89502
Attn: Dave Herzog

Phone: 689-7800 Fax: 689-7810

ELAP No: 2523
Received: 05/16/03
Lab Sample ID: 305-083 01-02
Reported: 05/28/03

Project Name/Number: Plumpjack/22705
Sample ID: see below
Date/ Time Collected: 05/14/03 @ 2000 & 2010
Sampled By: Client

Parameter	Method	Results	Units	Analyzed
IW				
Nitrate Nitrogen	300.0	<0.010	mg/L	05/16/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/16/03
Total Kjeldahl Nitrogen	351.3	0.053	mg/L	05/27/03
Total Nitrogen	calc.	0.053	mg/L	05/27/03
Total Phosphorus	365.3	<0.0050	mg/L	05/28/03
Turbidity	180.1	0.18	NTU	05/16/03
Total Dissolved Solids	2540C	96	mg/L	05/19/03
pH	150.1	5.28	SU	05/16/03
Iron	200.7	0.029	mg/L	05/21/03
Electrical Conductivity	2510B	100	uS/cm	05/29/03
SQ #1				
Nitrate Nitrogen	300.0	0.19	mg/L	05/16/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/16/03
Total Kjeldahl Nitrogen	351.3	0.29	mg/L	05/27/03
Total Nitrogen	calc.	0.48	mg/L	05/27/03
Total Phosphorus	365.3	0.044	mg/L	05/28/03
Turbidity	180.1	7.7	NTU	05/16/03
Total Dissolved Solids	2540C	63	mg/L	05/19/03
pH	150.1	6.69	SU	05/16/03
Iron	200.7	0.36	mg/L	05/21/03
Electrical Conductivity	2510B	55	uS/cm	05/29/03

Lance Bell, Lab Manger

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder
4875 Longley Lane, Suite 100
Reno, NV 89502
Attn: Dave Herzog

Phone: 689-7800 Fax: 689-7810

ELAP No: 2523
Received: 05/16/03
Lab Sample ID: 305-083 03-04
Reported: 05/28/03

Project Name/Number: Plumpjack/22705
Sample ID: see below
Date/ Time Collected: 05/14/03 @ 2015 & 05/15/03 @ 0800
Sampled By: Client

Parameter	Method	Results	Units	Analyzed
SQ #2				
Nitrate Nitrogen	300.0	0.14	mg/L	05/16/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/16/03
Total Kjeldahl Nitrogen	351.3	0.17	mg/L	05/27/03
Total Nitrogen	calc.	0.31	mg/L	05/27/03
Total Phosphorus	365.3	0.040	mg/L	05/28/03
Turbidity	180.1	6.3	NTU	05/16/03
Total Dissolved Solids	2540C	57	mg/L	05/19/03
pH	150.1	6.81	SU	05/16/03
Iron	200.7	0.25	mg/L	05/21/03
Electrical Conductivity	2510B	47	uS/cm	05/29/03
IW				
Nitrate Nitrogen	300.0	<0.010	mg/L	05/16/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/16/03
Total Kjeldahl Nitrogen	351.3	0.085	mg/L	05/27/03
Total Nitrogen	calc.	0.085	mg/L	05/27/03
Total Phosphorus	365.3	<0.0050	mg/L	05/28/03
Turbidity	180.1	<0.10	NTU	05/16/03
Total Dissolved Solids	2540C	96	mg/L	05/19/03
pH	150.1	5.48	SU	05/16/03
Iron	200.7	0.012	mg/L	05/21/03
Electrical Conductivity	2510B	100	uS/cm	05/29/03

Lance Bell, Lab Manger

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder
4875 Longley Lane, Suite 100
Reno, NV 89502
Attn: Dave Herzog

ELAP No: 2523
Received: 05/16/03
Lab Sample ID: 305-083 05-06
Reported: 05/28/03

Phone: 689-7800 Fax: 689-7810

Project Name/Number: Plumpjack/22705
Sample ID: see below
Date/ Time Collected: 05/15/03 @ 0810 & 0815
Sampled By: Client

Parameter	Method	Results	Units	Analyzed
SQ #1				
Nitrate Nitrogen	300.0	0.24	mg/L	05/16/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/16/03
Total Kjeldahl Nitrogen	351.3	0.11	mg/L	05/27/03
Total Nitrogen	calc.	0.35	mg/L	05/27/03
Total Phosphorus	365.3	0.055	mg/L	05/28/03
Turbidity	180.1	1.3	NTU	05/16/03
Total Dissolved Solids	2540C	68	mg/L	05/19/03
pH	150.1	7.16	SU	05/16/03
Iron	200.7	0.078	mg/L	05/21/03
Electrical Conductivity	2510B	50	uS/cm	05/29/03
SQ #2				
Nitrate Nitrogen	300.0	0.19	mg/L	05/16/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/16/03
Total Kjeldahl Nitrogen	351.3	0.13	mg/L	05/27/03
Total Nitrogen	calc.	0.32	mg/L	05/27/03
Total Phosphorus	365.3	0.0087	mg/L	05/28/03
Turbidity	180.1	0.92	NTU	05/16/03
Total Dissolved Solids	2540C	81	mg/L	05/19/03
pH	150.1	7.08	SU	05/16/03
Iron	200.7	0.076	mg/L	05/21/03
Electrical Conductivity	2510B	46	uS/cm	05/29/03

Lance Bell, Lab Manger

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder		ELAP No:	2523
4875 Longley Lane, Suite 100		Received:	05/16/03
Reno, NV 89502		Lab Sample ID:	305-083 07-08
Attn: Dave Herzog		Reported:	05/28/03

Phone: 689-7800 Fax: 689-7810

Project Name/Number:	Plumpjack/22705
Sample ID:	see below
Date/ Time Collected:	05/15/03 @ 2058 & 2102
Sampled By:	Client

Parameter	Method	Results	Units	Analyzed
IW				
Nitrate Nitrogen	300.0	<0.010	mg/L	05/16/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/16/03
Total Kjeldahl Nitrogen	351.3	0.082	mg/L	05/27/03
Total Nitrogen	calc.	0.082	mg/L	05/27/03
Total Phosphorus	365.3	<0.0050	mg/L	05/28/03
Turbidity	180.1	0.47	NTU	05/16/03
Total Dissolved Solids	2540C	90	mg/L	05/19/03
pH	150.1	5.70	SU	05/16/03
Iron	200.7	<0.010	mg/L	05/21/03
Electrical Conductivity	2510B	100	uS/cm	05/29/03
SQ #1				
Nitrate Nitrogen	300.0	0.23	mg/L	05/16/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/16/03
Total Kjeldahl Nitrogen	351.3	0.14	mg/L	05/27/03
Total Nitrogen	calc.	0.37	mg/L	05/27/03
Total Phosphorus	365.3	0.024	mg/L	05/28/03
Turbidity	180.1	4.4	NTU	05/16/03
Total Dissolved Solids	2540C	53	mg/L	05/19/03
pH	150.1	7.00	SU	05/16/03
Iron	200.7	0.22	mg/L	05/21/03
Electrical Conductivity	2510B	50	uS/cm	05/29/03

Lance Bell, Lab Manger

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder		ELAP No:	2523
4875 Longley Lane, Suite 100		Received:	05/16/03
Reno, NV 89502		Lab Sample ID:	305-083 09
Attn: Dave Herzog		Reported:	05/28/03

Phone: 689-7800 Fax: 689-7810

Project Name/Number:	Plumpjack/22705
Sample ID:	see below
Date/ Time Collected:	05/15/03 @ 2110
Sampled By:	Client

Parameter	Method	Results	Units	Analyzed
SQ #2				
Nitrate Nitrogen	300.0	0.20	mg/L	05/16/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/16/03
Total Kjeldahl Nitrogen	351.3	0.15	mg/L	05/27/03
Total Nitrogen	calc.	0.35	mg/L	05/27/03
Total Phosphorus	365.3	0.018	mg/L	05/28/03
Turbidity	180.1	3.6	NTU	05/16/03
Total Dissolved Solids	2540C	57	mg/L	05/19/03
pH	150.1	6.88	SU	05/16/03
Iron	200.7	0.17	mg/L	05/21/03
Electrical Conductivity	2510B	46	uS/cm	05/29/03

Lance Bell, Lab Manger

WET LAB

Western Environmental Testing Laboratory

992 SPICE ISLANDS DRIVE, SPARKS, NEVADA 89431 TEL. 775-355-0202 FAX. 775-355-0817

Lab Number: 305-083

Report Due Date: 5-26-03

Client: KLF. NEVADA		Fax Results Y N / Page of
Address		**PUBLIC WATER SUPPLY INFORMATION**
City, State & Zip		System Name
Contact: Varzari		PWS No. / Report to State/EPA Y N
Phone	Collector's Name: Varzari	POE No. / DWR No.
Fax	Project Name: Pinon Plant	Collection Point
P.O. Number	Project Number: 22705	City / County

SAMPLE TYPE CODES

DW = drinking water; TB = travel blank; WW = waste water; SD = solid; MW = monitoring well; SO = soil; HW = hazardous waste; SL = sludge

Compliance Monitoring Y N

TURNAROUND TIME REQUESTED

Standard / RUSH / Special — Lab Manager Approval

Analyses Requested

CLIENT'S SAMPLE ID/LOCATION	Date	Time	Sample Type	Containers	Total Nitrogen	Nitrate	TDS	Total Iron	pH	Turbidity	Total Phosphorus					Spl. No.
IW	5/14	2000	WW	3	Y	Y	Y	Y	Y	Y	Y					1
SQ#1	5/14	2010	SW	3	X	Y	X	X	Y	X	Y					2
SQ#2	5/14	2015	SW	3	X	Y	X	Y	X	Y	Y					3
IW	5/15	0300	WW	3	X	Y	X	X	X	Y	Y					4
SQ#1	5/15	0310	SW	3	Y	Y	X	X	Y	X	Y					5
SQ#2	5/15	0315	SW	3	Y	Y	Y	Y	Y	Y	Y					6
IW	5/15	2055	WW	3	Y	Y	Y	Y	Y	Y	Y					7
SQ#1	5/15	2102	SW	3	Y	Y	X	X	Y	X	Y					8
SQ#2	5/15	2110	SW	3	Y	Y	Y	Y	Y	Y	Y					9

Instructions/Comments/Special Requirements:

SAMPLE RECEIPT	Date	Time	Samples Relinquished By	Samples Received By
Received Cold (Y) N 4.5	5/16	1127	[signature]	M. Krane
Custody Seals Y N				
Seals Intact Y N				
No. of Containers 27				

WET Lab's Standard Terms and Conditions apply unless written agreements specify otherwise. Payment terms are Net 30.

To the maximum extent permitted by law, the Client agrees to limit the liability of WET Labs for the Client's damages to the total compensation received, unless other arrangements are made in writing. This limitation shall apply regardless of the cause of action or legal theory pled or asserted.

WET LAB
Western Environmental Testing Laboratory

June 13, 2003

WET Lab ID No.: 305-087

Kleinfelder Inc.
1875 Longley Ln, #100
Reno, NV 89502
Attn: Dave Herzog

Dear Mr. Herzog,

This is to transmit the attached analytical report. The analytical data and information contained therein was generated using specified or selected methods contained in references, such as Standard Methods for the Examination of Water and Wastewater, 18^{th} & 19^{th} editions, Methods for Determination of Organic Compounds in Drinking Water, EPA-600/4-79-020, and Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods (SW846) Third Edition.

The samples were received by WET Lab. in good condition on 05/16/03.

The analysis for Purgeable/Extractable TPH by EPA Method 8015B was performed by Sierra Analytical Laboratory. Their report is attached.

If you should have any questions or comments regarding this report, please do not hesitate to call.

Sincerely,

Lance Bell
Laboratory Manager
EPA Lab I.D. NV004

Enclosure

992 SPICE ISLANDS DRIVE, SPARKS, NEVADA 89431
TELEPHONE: 775-355-0202 FAX: 775-355-0817

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder
4875 Longley Lane, Suite 100
Reno, NV 89502
Attn: Dave Herzog

Phone: 689-7800 Fax: 689-7810

ELAP No: 2523
Received: 05/16/03
Lab Sample ID: 305-087 01-02
Reported: 05/28/03

Project Name/Number: Plumpjack/22705
Sample ID: see below
Date/ Time Collected: 05/16/03 @ 0900 & 0910
Sampled By: Client

Parameter	Method	Results	Units	Analyzed
IW				
Nitrate Nitrogen	300.0	<0.010	mg/L	05/17/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/17/03
Total Kjeldahl Nitrogen	351.3	0.073	mg/L	05/27/03
Total Nitrogen	calc.	0.073	mg/L	05/27/03
Total Phosphorus	365.3	<0.0050	mg/L	05/28/03
Turbidity	180.1	<0.10	NTU	05/16/03
Total Dissolved Solids	2540C	99	mg/L	05/19/03
pH	150.1	5.10	SU	05/16/03
Iron	200.7	<0.010	mg/L	05/21/03
Electrical Conductivity	2510B	80	uS/cm	05/29/03
SQ #1				
Nitrate Nitrogen	300.0	0.21	mg/L	05/16/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/16/03
Total Kjeldahl Nitrogen	351.3	0.11	mg/L	05/27/03
Total Nitrogen	calc.	0.32	mg/L	05/27/03
Total Phosphorus	365.3	0.0079	mg/L	05/28/03
Turbidity	180.1	0.93	NTU	05/16/03
Total Dissolved Solids	2540C	54	mg/L	05/19/03
pH	150.1	6.58	SU	05/16/03
Iron	200.7	0.036	mg/L	05/21/03
Electrical Conductivity	2510B	46	uS/cm	05/29/03

Lance Bell, Lab Manger

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder
4875 Longley Lane, Suite 100
Reno, NV 89502
Attn: Dave Herzog

ELAP No: 2523
Received: 05/16/03
Lab Sample ID: 305-087 04
Reported: 05/28/03

Phone: 689-7800 Fax: 689-7810

Project Name/Number: Plumpjack/22705
Sample ID: see below
Date/ Time Collected: 05/16/03 @ 0915
Sampled By: Client

Parameter	Method	Results	Units	Analyzed
SQ #2				
Nitrate Nitrogen	300.0	0.18	mg/L	05/16/03
Nitrite Nitrogen	300.0	<0.010	mg/L	05/16/03
Total Kjeldahl Nitrogen	351.3	0.13	mg/L	05/27/03
Total Nitrogen	calc.	0.31	mg/L	05/27/03
Total Phosphorus	365.3	0.010	mg/L	05/28/03
Turbidity	180.1	0.77	NTU	05/16/03
Total Dissolved Solids	2540C	70	mg/L	05/19/03
pH	150.1	6.46	SU	05/16/03
Iron	200.7	0.035	mg/L	05/21/03
Electrical Conductivity	2510B	60	uS/cm	05/29/03

Lance Bell, Lab Manger

SIERRA
ANALYTICAL

05 June 2003

Michelle Kramer
Western Environmental Testing Laboratory
992 Spice Islands Drive
Sparks, NV 89431

RE:305-087

Work Order No.: 0305235

Attached are the results of the analyses for samples received by the laboratory on 05/20/03 10:00.

The samples were received by Sierra Analytical Labs, Inc. with a chain of custody record attached or completed at the submittal of the samples.

The analyses were performed according to the prescribed method as outlined by EPA, Standard Methods, and A.S.T.M.

The remaining portions of the samples will be disposed of within 30 days from the date of this report.
If you require any additional retaining time, please advise us.

Sincerely,

Richard K. Forsyth

Richard K. Forsyth

Laboratory Director

26052 Merit Circle Suite 105, Laguna Hills, California 92653
Telephone: (949) 348-9389 Fax: (949) 348-9115
E-Mail: sierralabs@earthlink.net

SIERRA
ANALYTICAL

Western Environmental Testing Laboratory 992 Spice Islands Drive Sparks NV, 89431	Project: 305-087 Project Number: 305-087 Project Manager: Michelle Kramer	Reported: 06/05/03 11:12

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
IW	0305235-01	Water	05/16/03 14:10	05/20/03 10:00

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

26052 MERIT CIRCLE SUITE 105, LAGUNA HILLS, CALIFORNIA 92653
TELEPHONE: (949) 348-9389 FAX: (949) 348-9115
E-MAIL: SIERRALABS @ SIERALABS.NET

SIERRA ANALYTICAL

Western Environmental Testing Laboratory 992 Spice Islands Drive Sparks NV, 89431	Project: 305-087 Project Number: 305-087 Project Manager: Michelle Kramer	**Reported:** 06/05/03 11:12

Total Volatile Petroleum Hydrocarbons (TVPH) by GC/FID

Sierra Analytical Labs, Inc.

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
IW (0305235-01) Water Sampled: 05/16/03 14:10 Received: 05/20/03 10:00									
Gasoline Range Hydrocarbons (C4-C12)	ND	50	µg/L	1	B3E2004	05/20/03	05/21/03	EPA 8015B	
Surrogate: a,a,a-Trifluorotoluene		*77.5 %*	*70-125*		"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

26052 Merit Circle Suite 105, Laguna Hills, California 92653
Telephone: (949) 348-9389 Fax: (949) 348-9115
E-Mail: sierralabs @ sieralabs.net

SIERRA ANALYTICAL

Western Environmental Testing Laboratory 992 Spice Islands Drive Sparks NV, 89431	Project: 305-087 Project Number: 305-087 Project Manager: Michelle Kramer	**Reported:** 06/05/03 11:12

Total Petroleum Hydrocarbons (TPH) by GC/FID

Sierra Analytical Labs, Inc.

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
IW (0305235-01) Water Sampled: 05/16/03 14:10 Received: 05/20/03 10:00									
Diesel Range Organics (C10-C24)	ND	0.050	mg/L	1	B3F0314	05/30/03	06/03/03	EPA 8015B	
Surrogate: o-Terphenyl		*117 %*	*50-150*		"	"	"	"	
Oil Range Organics (C22-C36)	ND	0.050	"	"	"	"	"	"	
Surrogate: o-Terphenyl		*117 %*	*50-150*		"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

26052 Merit Circle Suite 105, Laguna Hills, California 92653
Telephone: (949) 348-9389 Fax: (949) 348-9115
E-Mail: sierralabs @ sieralabs.net

SIERRA ANALYTICAL

Western Environmental Testing Laboratory 992 Spice Islands Drive Sparks NV, 89431	Project: 305-087 Project Number: 305-087 Project Manager: Michelle Kramer	**Reported:** 06/05/03 11:12

Total Volatile Petroleum Hydrocarbons (TVPH) by GC/FID - Quality Control

Sierra Analytical Labs, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B3E2004 - EPA 5030B P & T										
Blank (B3E2004-BLK1)				Prepared: 05/20/03 Analyzed: 05/21/03						
Gasoline Range Hydrocarbons (C4-C12)	ND	50	µg/L							
Surrogate: a,a,a-Trifluorotoluene	*14.2*		"	*20.0*		*71.0*	*70-125*			
LCS (B3E2004-BS1)				Prepared: 05/20/03 Analyzed: 05/21/03						
Gasoline Range Hydrocarbons (C4-C12)	521	50	µg/L	600		86.8	80-120			
Matrix Spike (B3E2004-MS1)	**Source: 0305235-01**			Prepared: 05/20/03 Analyzed: 05/21/03						
Gasoline Range Hydrocarbons (C4-C12)	496	50	µg/L	600	ND	82.7	50-150			
Matrix Spike Dup (B3E2004-MSD1)	**Source: 0305235-01**			Prepared: 05/20/03 Analyzed: 05/21/03						
Gasoline Range Hydrocarbons (C4-C12)	546	50	µg/L	600	ND	91.0	50-150	9.60	30	

26052 Merit Circle Suite 105, Laguna Hills, California 92653
Telephone: (949) 348-9389 Fax: (949) 348-9115
E-Mail: sierralabs @ sieralabs.net

SIERRA ANALYTICAL

Western Environmental Testing Laboratory 992 Spice Islands Drive Sparks NV, 89431	Project: 305-087 Project Number: 305-087 Project Manager: Michelle Kramer	Reported: 06/05/03 11:12

Total Petroleum Hydrocarbons (TPH) by GC/FID - Quality Control

Sierra Analytical Labs, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B3F0314 - EPA 3520C Liquid Ext										
Blank (B3F0314-BLK1)				Prepared: 05/30/03 Analyzed: 06/03/03						
Diesel Range Organics (C10-C24)	ND	0.050	mg/L							
Oil Range Organics (C22-C36)	ND	0.050	"							
Surrogate: o-Terphenyl	*0.0750*		"	*0.0750*		*100*	*50-150*			
Surrogate: o-Terphenyl	*0.0750*		"	*0.0750*		*100*	*50-150*			
LCS (B3F0314-BS1)				Prepared: 05/30/03 Analyzed: 06/03/03						
Diesel Range Organics (C10-C24)	1.10	0.050	mg/L	1.00		110	80-120			
LCS (B3F0314-BS2)				Prepared: 05/30/03 Analyzed: 06/03/03						
Diesel Range Organics (C10-C24)	0.919	0.050	mg/L	1.00		91.9	80-120			
LCS Dup (B3F0314-BSD1)				Prepared: 05/30/03 Analyzed: 06/03/03						
Diesel Range Organics (C10-C24)	1.20	0.050	mg/L	1.00		120	80-120	8.70	30	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

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Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

APPENDIX D

Plumpjack Squaw Valley Aquifer Test Simulation

MEMORANDUM

To: Mr. Rob Goldberg/Plumpjack

From: Derrik Williams

Project: Plumpjack Squaw Valley Aquifer Test Simulation

Date: September 12, 2003

Subject: Simulation Results

Section 1.0
Introduction

The Plumpjack Resort (Plumpjack) owns a groundwater well in the western portion of Squaw Valley. Plumpjack would like to activate this well, or a similar well nearby, as part of their expansion plans. Well redevelopment and aquifer testing was performed on the well between May 3 and May 16, 2003.

The Squaw Valley Public Service District (SVPSD) requested Plumpjack investigate the impact of their well pumping on municipal water supply availability, and identify other impacts that the pumping may produce. Plumpjack hired Derrik Williams to investigate potential impacts using the Squaw Valley Groundwater Model. This memorandum presents the results of the impact analyses and the modeling effort.

The general approach adopted in these analyses was as follows:

- Incorporate aquifer test results into the groundwater model
- Recalibrate the groundwater model
- Run simulations estimating the impact of the Plumpjack well on the municipal water supplies and flows in Squaw Creek using the recalibrated groundwater model.
- Perform particle tracking to estimate impacts of pumping the Plumpjack well on the existing Plumpjack hydrocarbon plume.

Section 2.0
Aquifer Test Analysis

The Squaw Valley Groundwater Model uses estimates of hydrologic parameters such as hydraulic conductivity and storativity to simulate groundwater flow conditions. Constant rate aquifer tests, such as the test conducted between May 13 and May 16 on the

Plumpjack well, are a common source of these parameter estimates. The initial effort, therefore, was to analyze the aquifer test results to a degree that they could be incorporated into the model.

The analysis presented below is by no means a complete analysis of the aquifer test data. Kleinfelder and Associates, who conducted the aquifer test, will doubtlessly develop a complete analysis. This analysis uses data provided by Kleinfelder and Associates to develop initial estimates of hydraulic parameters that are consistent with the known geology, and can be included in the groundwater model.

2.1 Aquifer Test Data

Kleinfelder and Associates monitored water levels in the pumping well and seven monitoring wells during the constant rate aquifer test. Of these seven wells, data from only two wells show a significant apparent influence from the test pumping: well OW-1 and well SVL-MW1.

Kleinfelder and Associates installed well OW-1 expressly as a monitoring well for the aquifer tests. Well OW-1 is approximately 123 feet from the Plumpjack well, and is screened at depths similar to the Plumpjack well screen. Figure 1 shows semi-log plots of the water level data collected from well OW-1 during the aquifer test. Figure 1 shows both the raw data, and data corrected by Kleinfelder and Associates for an assumed linear water level rise that occurred during the test. The significant drawdown observed in well OW-1, along with the fact that well OW-1 is screened similarly to the Plumpjack well, lends this data to analytical analysis of the aquifer test.

Well SVL-MW1 existed previous to the aquifer test. Well SVL-MW1 is approximately 82 feet from the Plumpjack well. It is screened shallower than the Plumpjack well. Figure 2 shows semi-log plots of the water level data collected from well SVL-MW1 during the aquifer test. Figure 2 shows both the raw data, and data corrected by Kleinfelder and Associates for an assumed linear water level rise that occurred during the test. The relatively sizeable impact of background water level fluctuations, along with the fact that well SVL-MW1 is screened in a different zone than the Plumpjack well makes analytical analysis of the aquifer test difficult with the SVL-MW1 data. The data could, however, be used in the groundwater model to verify the estimated hydraulic parameters.

2.2 Aquifer Test Data Analysis

Analysis of water level data collected during the constant rate aquifer test can provide information that informs and verifies assumptions in the groundwater model. Potential information that can be garnered from test results includes estimating hydrologic properties, verifying conceptual flow models, and identifying flow boundaries.

2.2.1 CONCEPTUAL FLOW MODEL

Drawdown in an observation well completed in a confined aquifer with no boundaries will plot as a straight line on semi-log plots. Water level data from observation well OW-1 shows a significant change in the rate of drawdown after approximately 15 minutes of pumping (Figure 1). There are a number of possible explanations for this change in the drawdown rate. Common explanations include:

- The well may be pumping water from a surface water body, such as Squaw Creek.
- The aquifer may be semi-confined, and the change in drawdown rate indicates leakage from above
- The aquifer may be unconfined, and data from the first 15 minutes reflect early time processes, as described by Neuman (1974).

Water level data from well SVL-MW1 do not show the characteristic break in slope that may indicate flow from a stream or lake. Well SVL-MW1 is closer to the Plumpjack well than well OW-1, yet the observed drawdown in well SVL-MW1 is considerably less than the drawdown in well OW-1 (Figures 1 and 2). As previously noted, well SVL-MW1 is screened shallower than the Plumpjack well. This suggests that vertical anisotropy is limiting the drawdown in this well. Therefore it is likely that the correct conceptual flow model for this aquifer test is either a leaky confined aquifer, or a partially penetrated unconfined aquifer with vertical anisotropy.

As stated earlier, the influence of a leakage from a surface water body and the influence of leakage into an unconfined aquifer from above may look similar, particularly for relatively short aquifer tests. If we accept either the semi-confined aquifer or unconfined aquifer conceptual models suggested above, it is unlikely that we can use simple analytical analyses to discern any influence from Squaw Creek. Constraining the groundwater model by using the aquifer test results as prior knowledge, however, may allow improved calibration of the aquifer-stream interaction in the model.

2.2.2 HYDROLOGIC PROPERTIES

Analytical solutions to aquifer tests are used to estimate hydrologic properties of aquifers. A number of solutions have been proposed for various aquifer geometries. Based on the conceptual models identified above, we analyzed the data with two solutions: Hantush's solution for leaky aquifers with partially penetrating wells (1956), and Neuman's solution for unconfined aquifers with vertical anisotropy and partially penetrating wells (1974).

2.2.2.1 Hantush (1956)

The Hantush solution was developed for wells partially penetrating a confined aquifer that receives recharge through leakage from above. The theoretical basis for this solution will not be presented here. The solution is a curve-matching solution, with a family of type curves. Each type curve corresponds to a unique value of r/B, where:

r = radial distance from pumping well

$$B = \sqrt{KD\frac{D'}{K'}}$$

K = hydraulic conductivity of the aquifer
D = aquifer thickness
K'= vertical conductivity of the overlying aquitard
D'= aquitard thickness

Figure 3 shows the result of the Hantush curve-matching solution. Note that only data from the first 350 minutes of the aquifer test are shown. These data shows the least influence from background water table fluctuations, and therefore are considered the most representative of the influence from the Plumpjack well pumping. Assuming an aquifer thickness of 60 feet (the Plumpjack well screen length), the estimated transmissivity of 1800 feet^2/day yields a hydraulic conductivity of 30 feet/day. This is approximately half the value in the current groundwater model. Additionally, the storage coefficient of 0.00023 is two orders of magnitude greater than in the current model

Assuming K = 30 feet per day, D = 60 feet, and r = 123 feet, we can calculate the aquitard diffusivity (D'/K').

$$\frac{r}{B} = \frac{r}{\sqrt{KD\frac{D'}{K'}}}$$

$$0.5 = \frac{123}{\sqrt{30 \times 60 \times \frac{D'}{K'}}}$$

$$\frac{D'}{K'} = 34$$

Although we do not know the thickness of the aquitard (D'), we can bound estimates of the vertical conductivity. If D' was a relatively thin 5 feet, K' would equal 0.15 feet per day. If D' were a thicker 30 feet, K' would equal 0.9 feet per day.

2.2.2.2 Neuman (1974)

The Neuman solution was developed for wells that partially penetrate an unconfined aquifer with vertical anisotropy. The theoretical basis for this solution will not be presented here. The solution is a curve-matching solution, with a family of type curves. Each type curve corresponds to a unique value of β, where:

$$\beta = \left(\frac{r}{D}\right)^2 \frac{K_v}{K_h}$$

K_v = vertical conductivity of the aquifer
K_h = horizontal conductivity of the aquifer

Figure 4 shows the result of the Neuman curve-matching solution. Assuming an aquifer thickness of 120 feet (the entire Plumpjack well depth), the transmissivity of 1924 feet^2/day yields a hydraulic conductivity of 16 feet/day. This is approximately one quarter the value in the current model. The estimated storage coefficient of 0.00023 is the same coefficient estimated by the Hantush method.

Using a value of β=0.102, we can calculate the vertical conductivity as follows:

$$\beta = \left(\frac{r}{D}\right)^2 \frac{K_v}{K_h}$$

$$0.102 = \left(\frac{123}{120}\right)^2 \frac{K_v}{16}$$

$$K_v = 1.55$$

This suggests a horizontal to vertical anisotropy of roughly 10 to 1.

2.3 Aquifer Test Conclusions

As stated earlier, the analyses presented above do not constitute a complete analysis of the Plumpjack well aquifer test. The analyses are determinative enough, however, to draw the following conclusions about the aquifer around the Plumpjack well.

- The aquifer can be viewed as either a leaky confined aquifer or an unconfined aquifer with vertical anisotropy. The lack of extensive confining layers in this portion of the basin suggests that the latter interpretation is likely the more reasonable one.
- The data are insufficient to extract conclusions about aquifer-stream interactions using common analytical aquifer test solutions. The data may be sufficient to infer aquifer-stream interactions, however, by including the aquifer test data in the groundwater model.
- The aquifer hydraulic conductivity is on the order of 15 to 30 feet per day.
- The aquifer vertical conductivity (assuming an unconfined anisotropic aquifer) is on the order of 1.5 feet per day.

It is worth noting that these are initial aquifer parameter estimates. These may not be the exact aquifer parameters that result in a calibrated groundwater model.

Section 3.0
Aquifer Test Simulation

To ensure consistency between the aquifer test results and the existing groundwater model, we simulated the aquifer test with the existing Squaw Valley groundwater model. After an initial simulation, the hydraulic parameters in the model were modified in accordance with aquifer test results. The model calibration became an iterative process between calibrating parameters for the aquifer test and calibrating parameters for the original 1992-1999 model calibration. The general process was as follows:

1. Simulate the aquifer test using the original model parameters
2. Modify the model parameters in accordance with the aquifer test results
3. Calibrate the model to simulate the aquifer test results by changing model parameters.
4. Incorporate the new model parameters into the original 1992-1999 model
5. Further modify the aquifer parameters to calibrate the 1992-1999 model
6. Revisit the aquifer test simulation with the further modified model parameters
7. Iterate steps 3 through 6 until a single set of parameters adequately simulates both the aquifer test data and the 1992-1999 calibration data

3.1 Simulated Time Distribution

The Plumpjack constant rate aquifer test was performed between May 13 and May 16, 2003. It is common to see the greatest change in water levels during the early portion of aquifer tests. Therefore, we employed the following stress periods in the groundwater model.

Stress Period 1.	31 days – Simulates a month of pumping without the Plumpjack well to set up the general flow field
Stress Period 2.	20 minutes with 1-minute steps. This simulates the time when greatest water level changes were observed during the test.
Stress Period 3.	4683 minutes, with progressively longer steps. This stress period runs to the end of the pumping period (4703 minutes).
Stress Period 4.	213 minutes with progressively longer steps. This stress period covers the time of the monitored recovery.

3.2 Simulated Stream Flow During the Aquifer Test

Patrick Stiehr from Watermark Engineering estimated that the stream flow in the northern branch of Squaw Creek may have been 50 cfs during the test (4,320,000 ft3/day), and the stream flow in the southern branch of Squaw Valley Creek may have been half that (personal communication). These values were entered into the model in for the stress periods that simulate the pumping period (stress periods 2, 3, and 4).

3.3 Well Locations

The well locations provided by Kleinfelder & Associates were not associated with any standard coordinate system. Therefore, the well locations were estimated from a map provided by Kleinfelder & Associates. The estimated California State Plane well coordinates for various wells include:

Well	Easting	Northing
Plumpjack	7061196.1	2202626.3
OW1	7061318.1	2202611.3
SVLMW1	7061189.1	2202544.3
99-01	7061578.1	2202811.3
99-02	7061446.1	2202601.3
P-1	7061187.1	2202869.3
P-2	7061188.1	2202839.3
P-3	7061190.1	2202810.3

3.4 Simulated Water Level Targets

Target data were initially imported for two wells OW-1 and SVL-MW1. Data from the pumping well were not initially included because no well efficiency corrections had been calculated. The drawdown data corrected for an assumed linear rise in background water levels were used as the basis for the target data. Representative data from the first 350 minutes of the aquifer test were used as target data.

3.5 Simulation Results

Figures 5 and 6 compare the simulated water levels in well OW-1 and SLV-MW1 with the water levels measured during the aquifer test. As with the aquifer test analysis presented earlier, only the initial 350 minutes of data are shown. The simulated water levels for well OW-1 show a very good match with the measured water levels. The simulated water levels for well SLV-MW1 approximately follow the measured drawdown, although the simulated drawdown shows fluctuations not seen in the measured data.

The final calibrated model parameters for the zone that encompasses the Plumpjack well are as follows:

Horizontal hydraulic conductivity ....60 feet/day
Vertical hydraulic conductivity ....0.5 feet/day
Storativity..0.0002

Note that the final aquifer parameters are similar, although not identical, to the parameters identified in the aquifer test analyses.

Section 4.0
Water Supply Impacts

Potential impacts from pumping the Plumpjack well were investigated using the re-calibrated groundwater model. Three aspects of Plumpjack's demands were simulated:

the impact on water supply availability, the impact on nearby hydrocarbon plumes, and the impact on Squaw Creek flows.

4.1 PLUMPJACK DEMANDS

Plumpjack proposed three demand scenarios. The first scenario provides water solely for the Plumpjack resort. The second scenario provides water for the Plumpjack resort and phases III and IV of the Intrawest project. The third scenario envisions the Plumpjack well as an integral part of the basin water supply system, and allows the well to be pumped at the maximum pumping rate.

4.1.1 SCENARIO 1 DEMANDS – PLUMPJACK ONLY

Water supply requirements for the Plumpjack facility were estimated by K.B. Foster Inc. The Plumpjack facility will be able to house up to approximately 121 people when fully built. Using an estimated demand of 100 gallons per day per person, the Plumpjack resort could require 12,100 gallons per day. Additionally, the Plumpjack facility could require approximately 2,500 gallons per day for irrigation during summer months. The maximum daily demand is therefore 14,600 gallons per day, or approximately 10 gallons per minute.

The estimated Plumpjack demands were distributed throughout the year using data from the Squaw Valley Groundwater Development & Utilization Study (West Yost & Associates, 2001). Table 1 shows the estimated monthly demand as a percentage of annual demand in Squaw Valley. Data for this table were extracted from Table 5-11 of the Squaw Valley Groundwater Development & Utilization Study.

Table 1
Estimated Monthly Demand in Squaw Valley

Month	Percentage of Annual Demand
January	7.73%
February	6.99%
March	7.30%
April	6.50%
May	6.69%
June	9.75%
July	13.07%
August	13.37%
September	10.18%
October	6.87%
November	4.66%
December	6.87%
Total	100.00%

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The non-irrigation demand was distributed in accordance with the percentages shown on Table 1. Table 1 shows that the greatest demand in Squaw Valley occurs in August. Therefore, the maximum non-irrigation demand of 12,100 gallons per day was assigned to August. Non-irrigation demands for other months were calculated as a percentage of the August demand. As an example, the May demand is one half the August demand because May requires 6.69% of annual demand compared with Augusts 13.37%. An irrigation demand of 2500 gallons per day was added between May 15 and October 15. The final distribution of demands is shown on Table 2.

Table 2
Estimated Monthly Plumpjack Demand

Month	Daily Non-Irrigation Demand (gallons/day)	Daily Total Demand (gallons/day)
January	6,993.58	6,994
February	6,327.52	6,328
March	6,605.05	6,605
April	5,883.49	5,883
May	6,050.00	7,300
June	8,825.23	11,325
July	11,822.48	14,322
August	12,100.00	14,600
September	9,213.76	11,714
October	6,216.51	7,467
November	4,218.35	4,218
December	6,216.51	6,217
Average	7,539.37	8,581

4.1.2 SCENARIO 2 DEMANDS – PLUMJACK AND INTRAWEST PHASES III AND IV

Kleinfelder and Associates estimated the demand for the Intrawest Phase III and IV to be 67,945 gallons per day, or approximately 47 gallons per minute. Assuming this represents the maximum (August) demand, the monthly demand can be calculated by correlating this 67,945 gallons per day with 13.37% of the annual demand, from Table 1. All other monthly demands can then be calculated from the percentages shown on Table 1, to develop the annual pumping distribution shown on Table 3.

Table 3 Estimated Monthly Plumpjack and Intrawest Demand		
Month	Daily Intrawest Demand (gallons/day)	Daily Total Demand (gallons/day)
January	39,271	46,265
February	35,531	41,858
March	37,089	43,694
April	33,037	38,921
May	33,973	41,273
June	49,556	60,881
July	66,387	80,709
August	67,945	82,545
September	51,738	63,452
October	34,908	42,374
November	23,687	27,906
December	34,908	41,124
Average	42,336	50,917

4.1.3 SCENARIO 3 DEMANDS – MAXIMUM PUMPING RATE

The Plumpjack well maintained an average pumping rate of 142 gallons per minute during the aquifer test. Kleinfelder & Associates assumed that this is the maximum pumping rate that the Plumpjack well could maintain during regular operation. Assuming the Plumpjack well will operate no more than 80% of the time, the peak pumping rate would be 113.6 gallons per minute (163,584 gallons/day) during any one month.

As with the previous scenarios, the maximum rate of 114 gallons per day was assigned to the August demand, and the demands for all other months were calculated from the percentages shown on Table 1. The monthly demands for the maximum pumping scenario are shown on Table 4.

Table 4 Estimated Monthly Demand for Maximum Pumping Scenario	
Month	Daily Total Demand (gallons/day)
January	94,549
February	85,544
March	89,296
April	79,541
May	81,792
June	119,311
July	159,832
August	163,584
September	124,564
October	84,043
November	57,029
December	84,043
Average	101,927

4.2 Plumpjack Pumping Simulation

The impact from the Plumpjack pumping was estimated by simulating the 1992 to 1994 period both with and without pumping the Plumpjack well. The 1994 drought was simulated for two consecutive years, to estimate the impact of the Plumpjack well on water levels during an extended drought.

4.2.1 WATER LEVEL RESULTS

The impact on water supply was estimated by analyzing simulated water levels in well SVPSD#2. Simulated water levels were compared between a simulations with no pumping from the Plumpjack well, and a simulation with the Plumpjack well pumped in accordance with the rates shown on Tables 2, 3, and 4. Well SVPSD#2 was chosen as the key indicator because previous investigations have shown that the water level in well SVPSD#2 is the limiting factor on the amount of water that can safely be extracted annually from existing wells.

Figure 7 shows simulated water levels for the various simulations. Pumping the Plumpjack well at the rates developed for scenario 2 has only a minimal impact on the water levels in well SVPSD#2. This implies that the Plumpjack well could be operated at relatively low flows, supplying only the Plumpjack resort, with minimal impact on the current water supply.

Figure 7 additionally shows that the pumping the Plumpjack well to supply the Intrawest development, or at the maximum pumping rate, will result in a noticeable impact to water levels in well SVPSD#2. Of particular note, simulated water levels in well SVPSD#2 drop below the minimum allowable water level for that well. This is unsurprising, as water levels in well SVPSD#2 dropped to near the minimum allowable water level during the 1994 drought, and any significant additional stresses on the groundwater basin will only lower the water levels further. This suggests that coordinating pumping between the Plumpjack well and other supply wells in the basin will be necessary if the Plumpjack well is used for anything more than supplying water directly to the Plumpjack resort. The coordination generally requires lessening pumping from well SVPSD#2 to increase pumping in other wells.

Previous simulations for the SVPSD have estimated maximum pumping rates for the Squaw Valley Basin. A production well was assumed to exist near the existing Plumpjack well in the previous simulations. By optimizing the pumping rates for all production wells in the basin, the previous simulations estimated that the Plumpjack well could pump at an average rate of up to 47,760 gallons per day with a maximum (August) rate of 75,256 gallons per day. This is similar to the average and maximum pumping rates assumed in scenario 2. Additional simulation showed that it is possible that this pumping rate could be increased if some modifications are made to well SVPSD#2, allowing additional drawdown in that well.

4.2.2 WATER QUALITY RESULTS.

Pumping the Plumpjack well may influence the flow and transport of nearby hydrocarbon plumes. The Squaw Valley Groundwater Model was not developed to simulate contaminant transport, and insufficient data exist for calibrating a basin wide contaminant transport model. Limited conclusions can be drawn, however, from particle tracking combined with the aquifer test results.

Particle tracking is a technique for showing the flow direction of a water particle in a groundwater model. Particle tracking can show the influence of pumping on flow directions. If pumping a well has a significant influence on flow directions, the well may, by inference, have a significant influence on the fate and transport of contaminants in the same area.

The area of groundwater impacted by hydrocarbon contamination beneath the Plumpjack property was estimated from Figure 4 of the Status Report for the Squaw Valley Inn soils and groundwater investigation (Kleinfelder, 1987). Figure 8 shows the starting locations of the particles used in the particle tracking. Three particles were started at each location – evenly spaced through the thickness of model layer 1. These particle locations approximate the area of groundwater contamination identified by Kleinfelder (1987).

Figures 9 through 12 show the simulated particle paths both with and without pumping the Plumpjack well. No significant differences in particle paths are apparent between the no-pumping simulation (Figure 9) and scenario 1 (Figure 10). Particle tracks for scenarios 2 and 3, shown on Figures 11 and 12, show some variation in the particle tracks. This implies that the higher pumping rates may have some influence on the flow direction of Plumpjack's estimated hydrocarbon plume.

We must emphasize that these conclusions concerning the impact of pumping on the estimated hydrocarbon plume is based on limited knowledge of the hydrocarbon plume, or other contaminant sources that may impact the Plumpjack well. Furthermore the groundwater model is not calibrated to water levels west of well SVPSD#2, leading to some uncertainty with the model's predictive ability in this area. We recommend that the known hydrocarbon plumes be rigorously monitored if the Plumpjack well is operated for water supply. Regular and strict monitoring of the any contaminant plumes may show impacts from the Plumpjack well pumping not simulated by the groundwater model.

4.2.3 STREAM FLOW RESULTS

Pumping the Plumpjack well may impact flows in Squaw Creek. The degree of impact appears to be small, as shown in Figure 13. This figure graphs the simulated Squaw Creek flow for the base case and all three pumping simulations. The differences in creek flow are too small to be noticeable at this scale. While the simulated stream losses can be on the order of 1000 ft^3/day, this is indistinguishable at the scale of Figure 13. This may, however, be an important change in stream flows during summer and autumn months, when the stream flows are the lowest.

We should note that the simulated stream flows are estimates, and accurate stream flow data is only now being collected. As these stream data become available they will be incorporated into the model to improve model accuracy.

Section 5.0
Conclusions

Analyses of aquifer test results from the Plumpjack aquifer test performed in May of 2003 suggest the following.

- The test results suggest that the aquifer around the Plumpjack well may have a somewhat lower horizontal conductivity than estimated by previous investigations. Test results suggest a conductivity of between 15 and 30 feet per day.
- The test results suggest that the aquifer around the Plumpjack well may have a storativity of approximately 0.0002. This is higher than previously estimated with the groundwater model.
- The aquifer test results cannot be used to estimate aquifer-stream interactions directly. Constraining the groundwater model by using the aquifer test results as prior knowledge, however, allows improved calibration of the aquifer-stream interaction in the model.
- The Plumpjack well could be operated solely for the purpose of supplying the Plumpjack resort with only minimal impact on the current water supply.

- The Plumpjack well could supply water beyond the needs of the Plumpjack resort, but the Plumpjack well would need to be operated in coordination with other production wells in the basin. This implies that the Plumpjack well should be incorporated into the overall water supply system.
- The Plumpjack well has little impact on the simulated Squaw Creek flows during high-flow months. As the simulated flows in Squaw Creek diminish, the relative impact of the pumping increases.
- Preliminary analyses suggest that operating the Plumpjack solely for supplying the Plumpjack resort will have little impact on the existing Plumpjack hydrocarbon groundwater plume, however any additional pumping beyond the needs of the Plumpjack resort may influence the plumes flow direction. This conclusion is tentative, and based on incomplete data. All known or suspected contaminant plumes should be rigorously monitored if the Plumpjack well is operated for water supply.

Section 6.0
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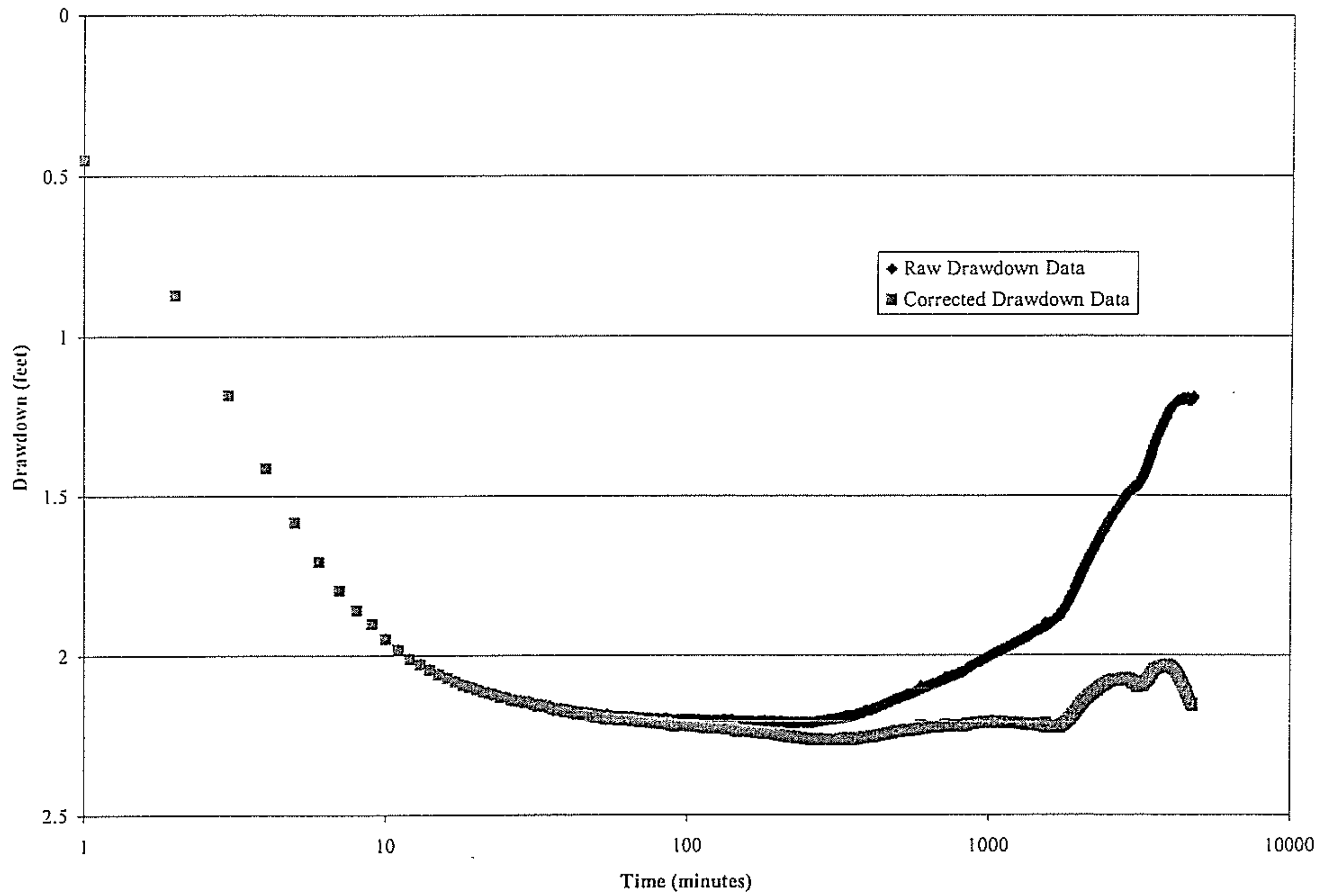
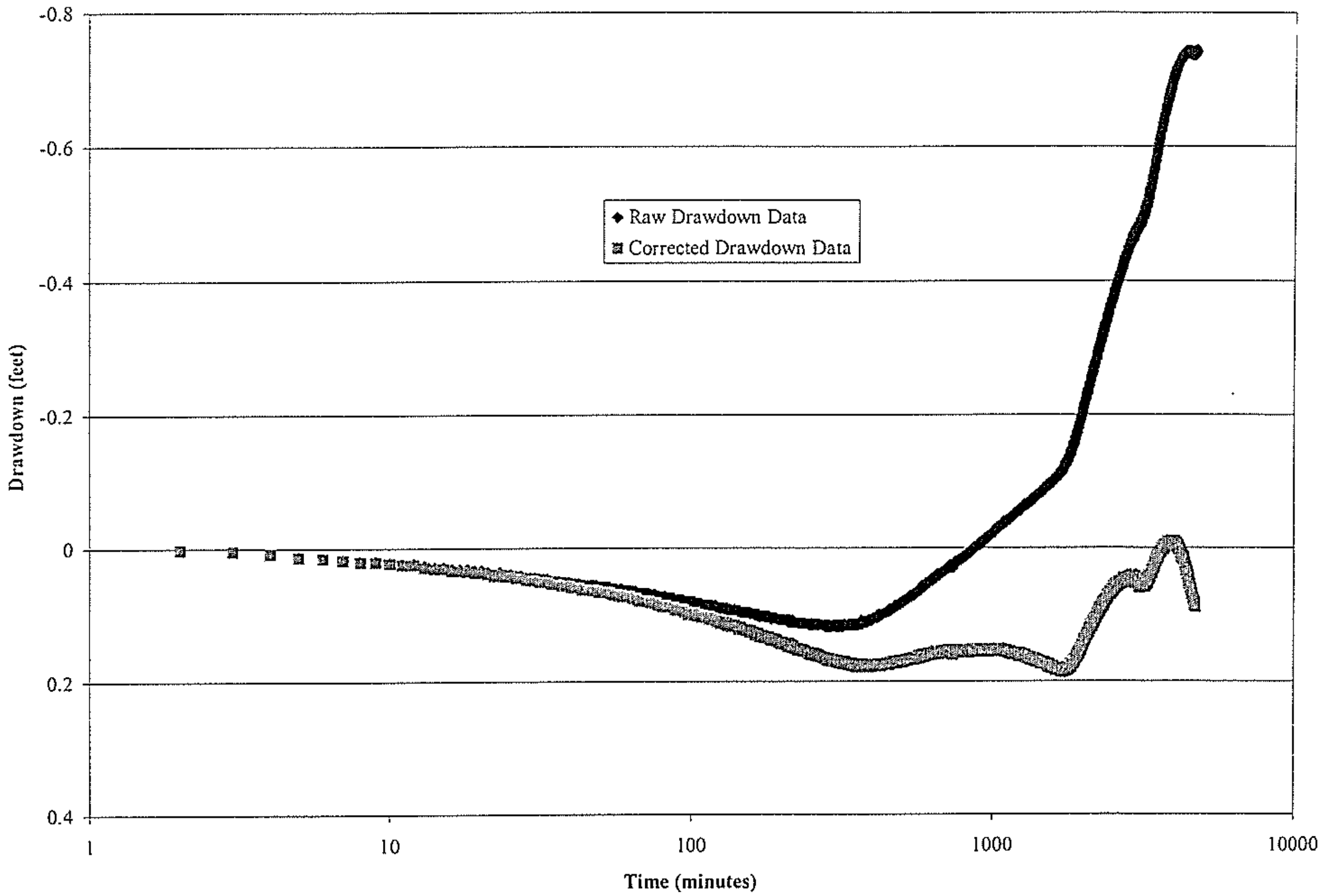


derrik williams

Drawdown Measured in Well OW-1
During the Plumpjack Well Aquifer Test

Figure
1



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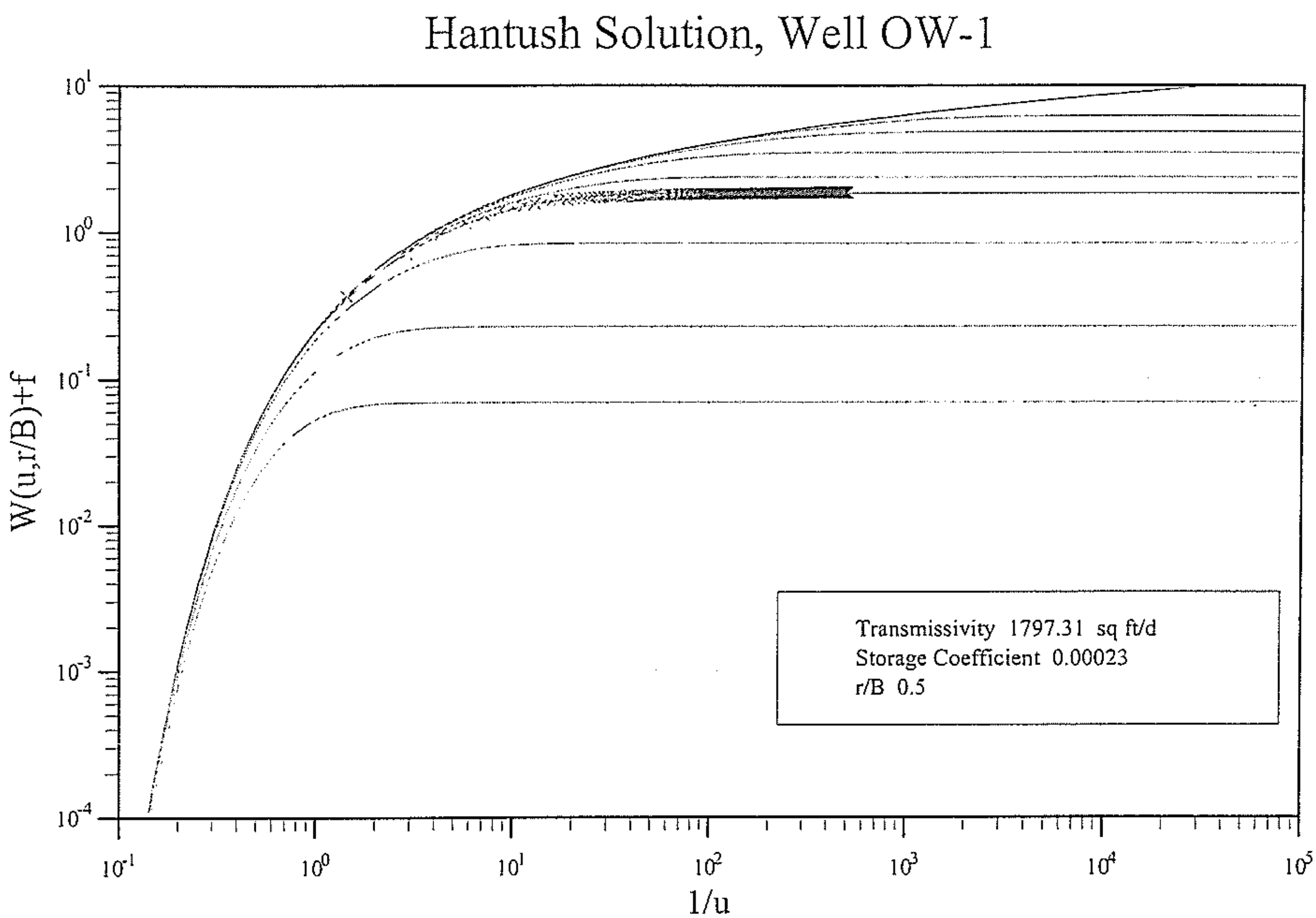
Drawdown Measured in Well SVL-MW1
During the Plumpjack Well Aquifer Test

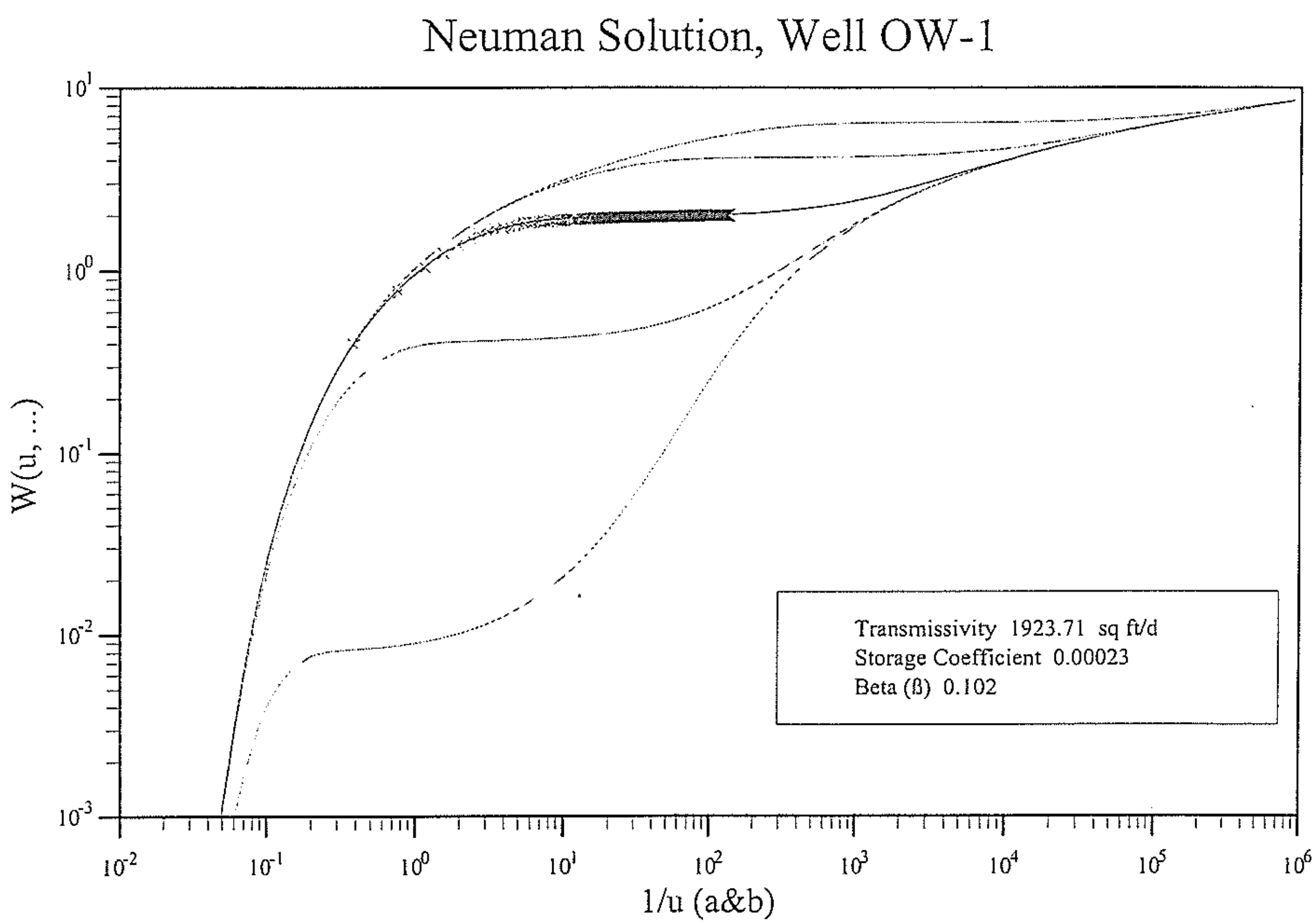
Figure
2



derrik williams

Hantush Solution for Well OW-1
Plumpjack Well Aquifer Test

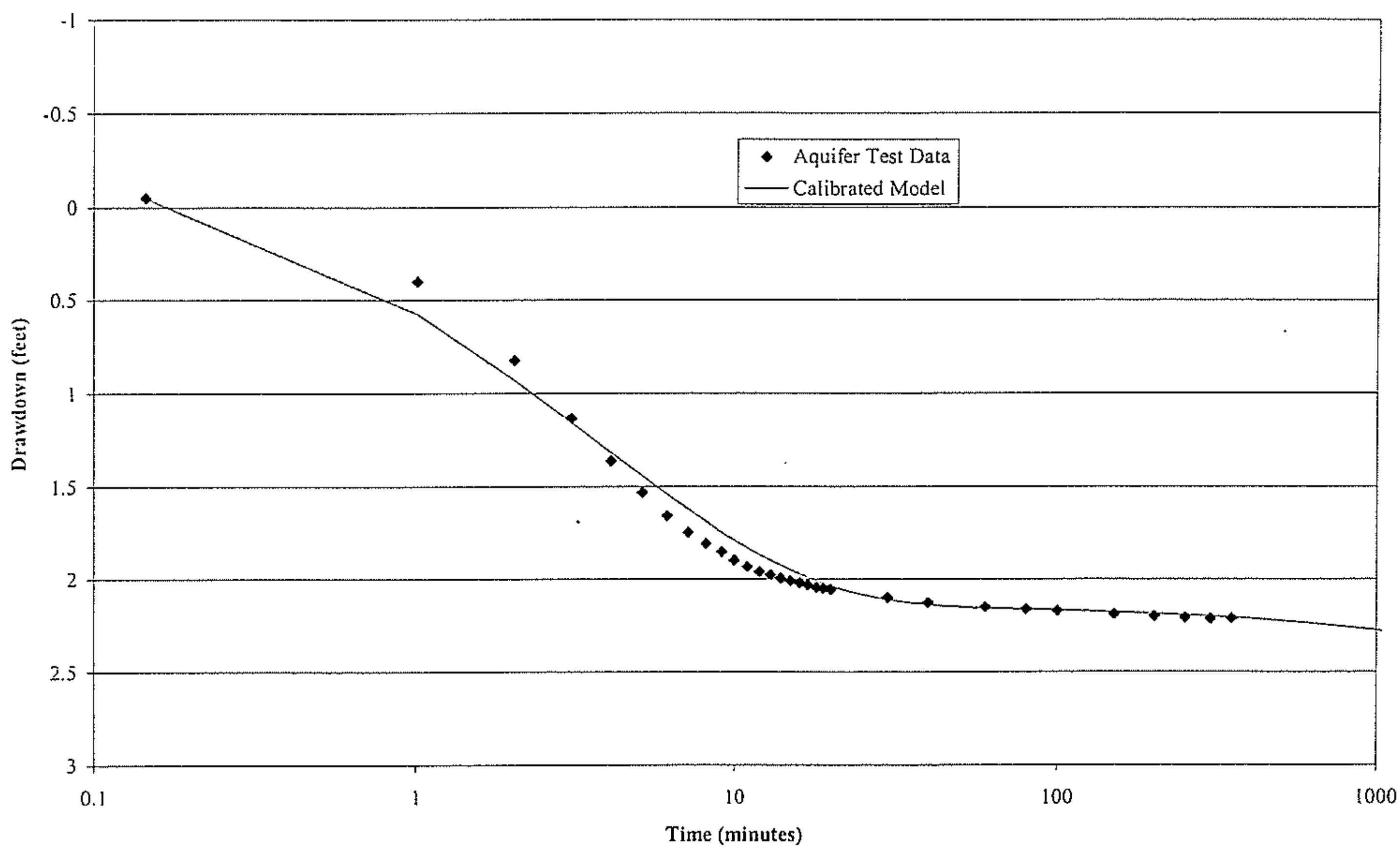
Figure
3



derrik williams

Neuman Solution for Well OW-1
Plumpjack Well Aquifer Test

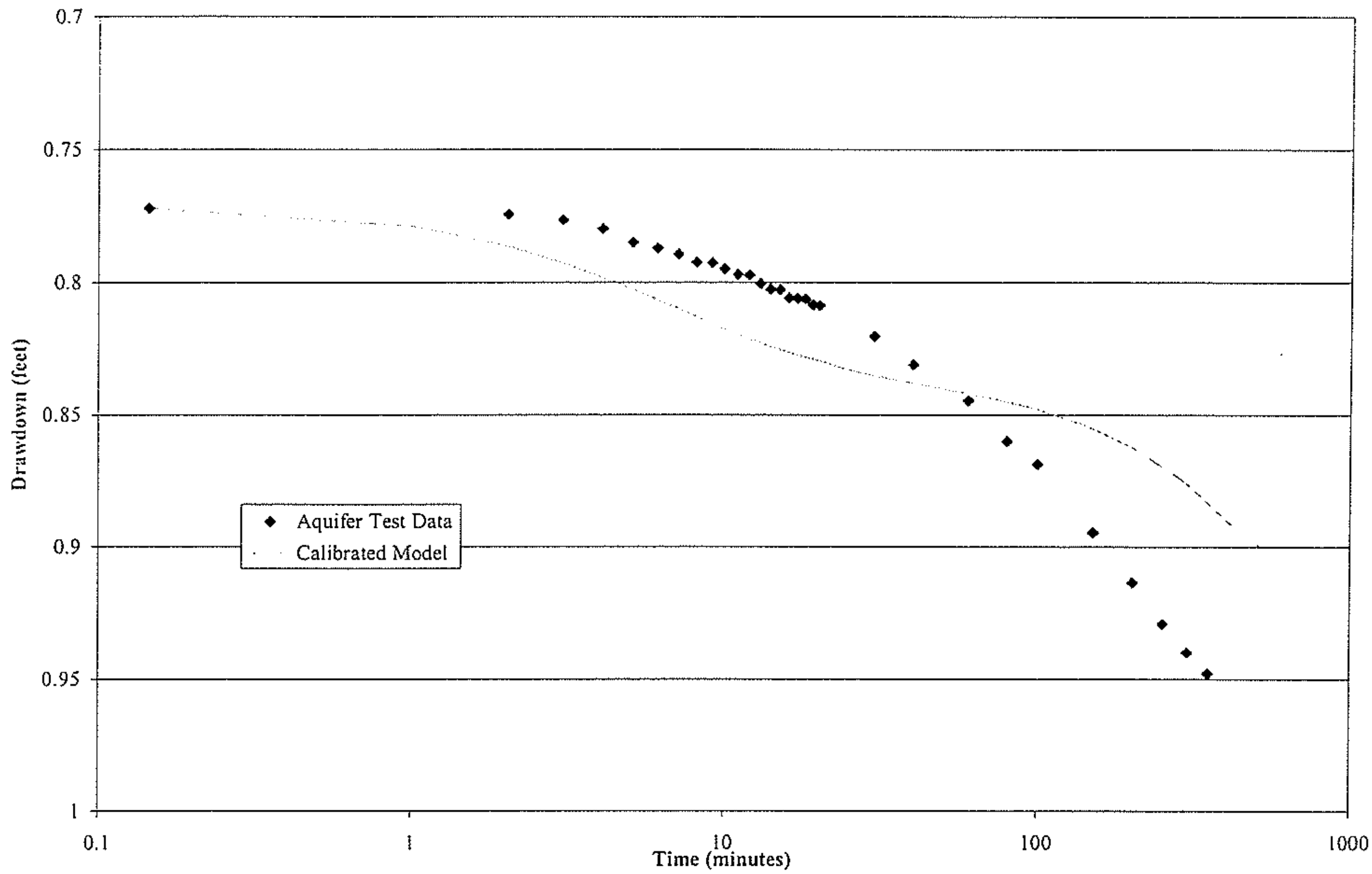
Figure 4



derrik williams

Measured and Simulated Water Levels in Well OW-1
Plumpjack Well Aquifer Test

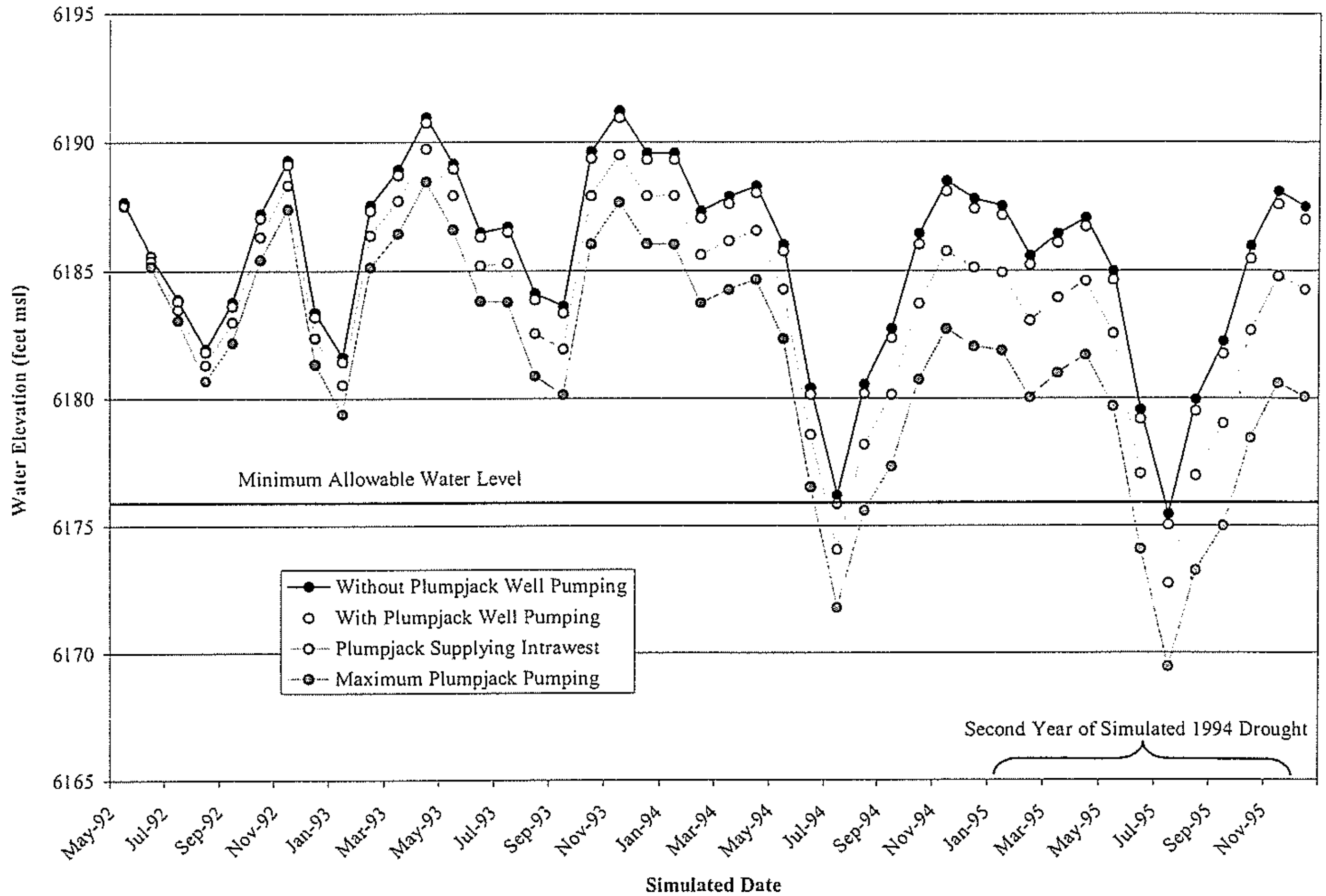
Figure
5



derrik williams

Measured and Simulated Water Levels in Well SVL-MW1
Plumpjack Well Aquifer Test

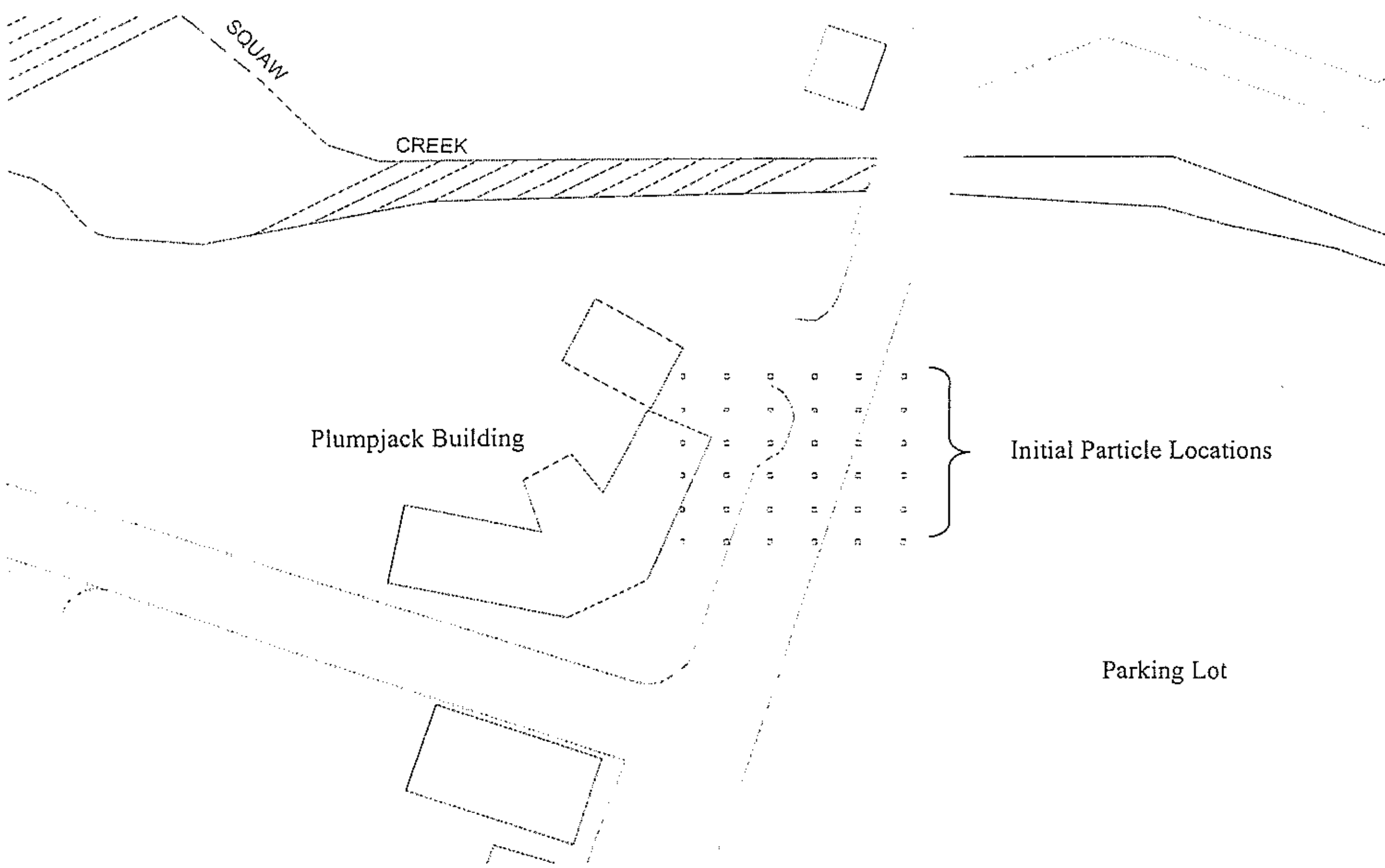
Figure
6



derrik williams

Simulated Water Levels in Well SVPSD#2
With and Without the Plumpjack Well Pumping

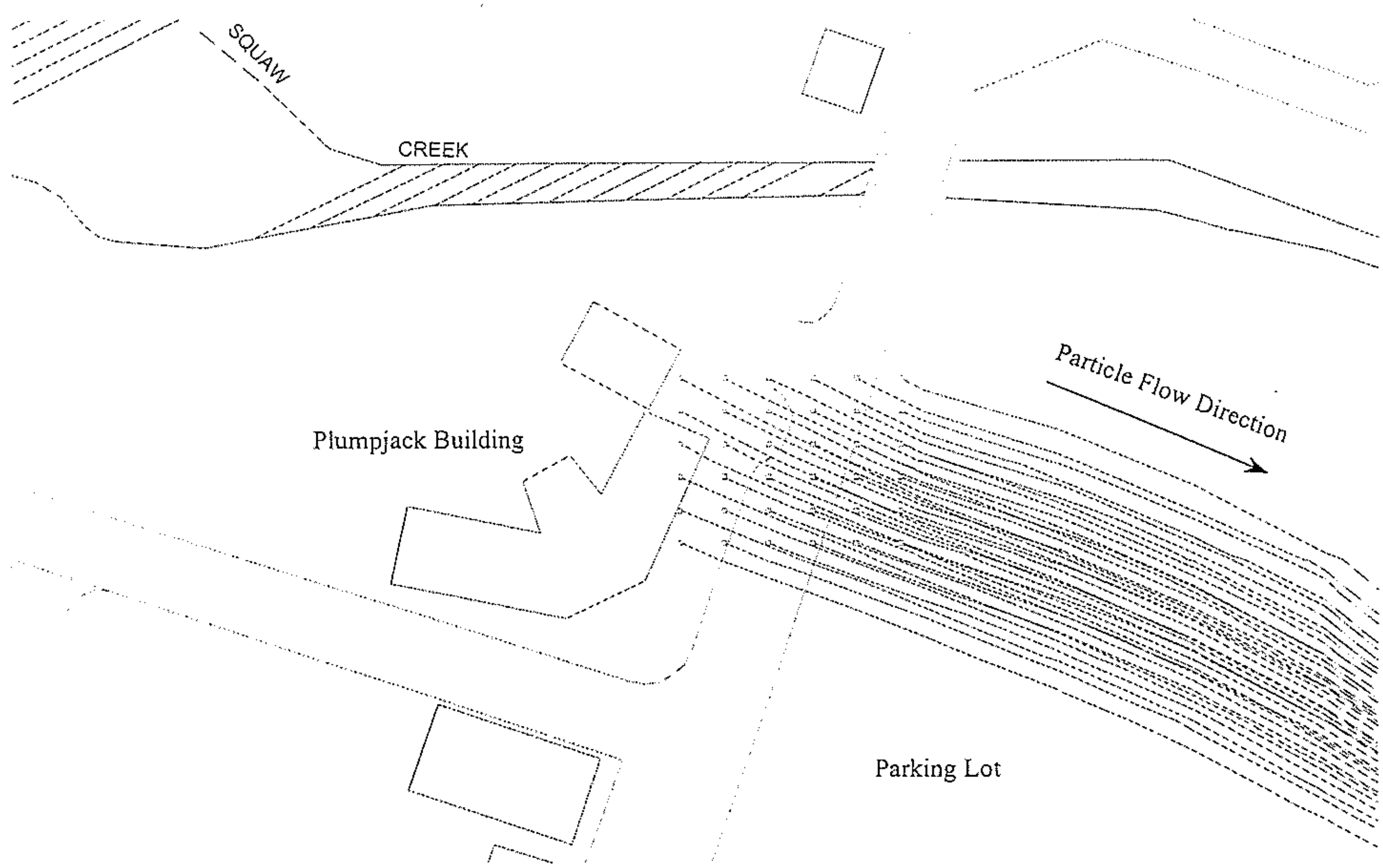
Figure
7



derrik williams

Initial Locations of Particles Used for Particle Tracking

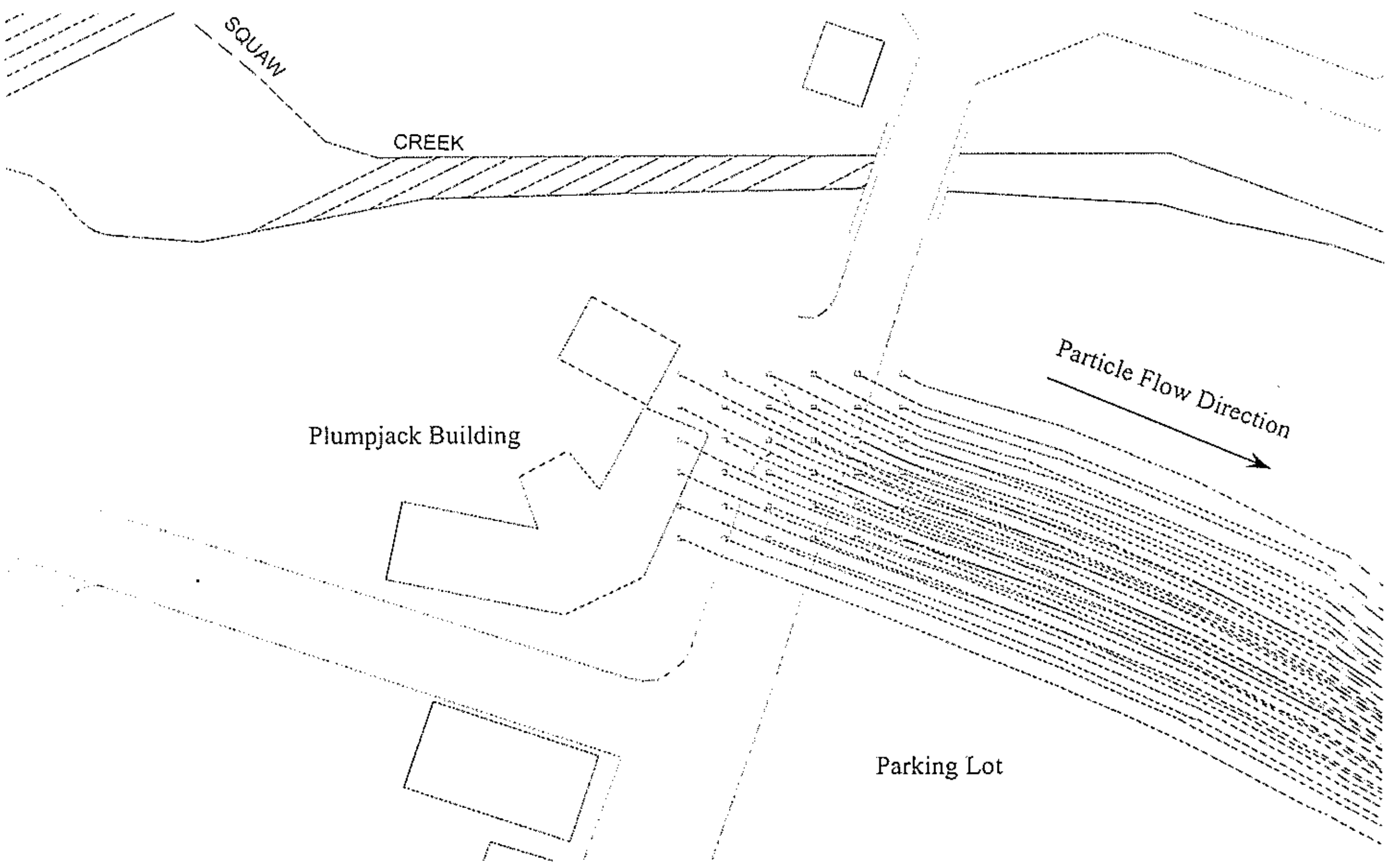
Figure 8



derrik williams

Particle Tracks from the Simulation of Scenario 1, With No Pumping from the Plumpjack Well

Figure 9



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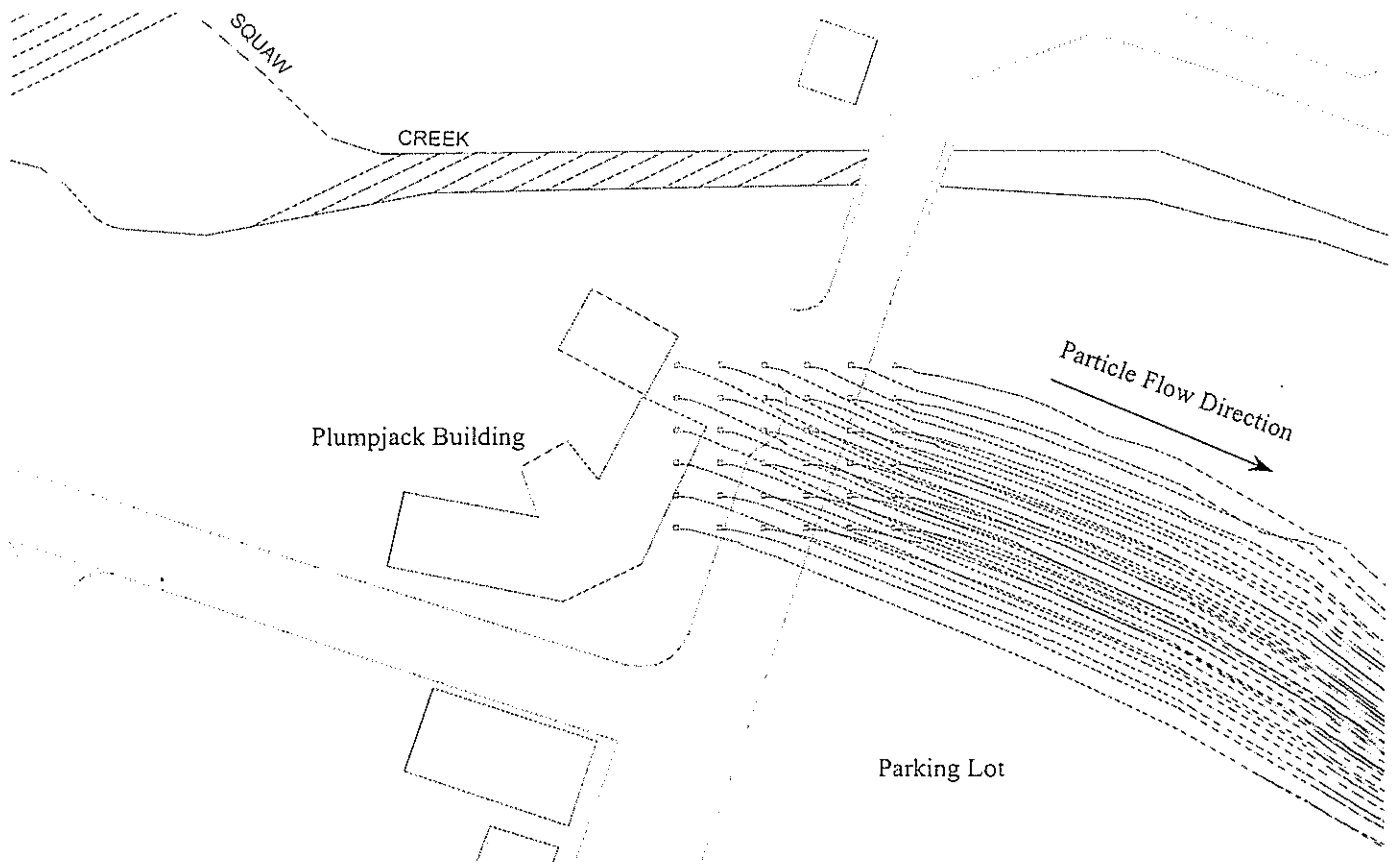
Particle Tracks from the Simulation of Scenario 2, Including Pumping the Plumpjack Well Solely for the Plumpjack Resort

Figure 10



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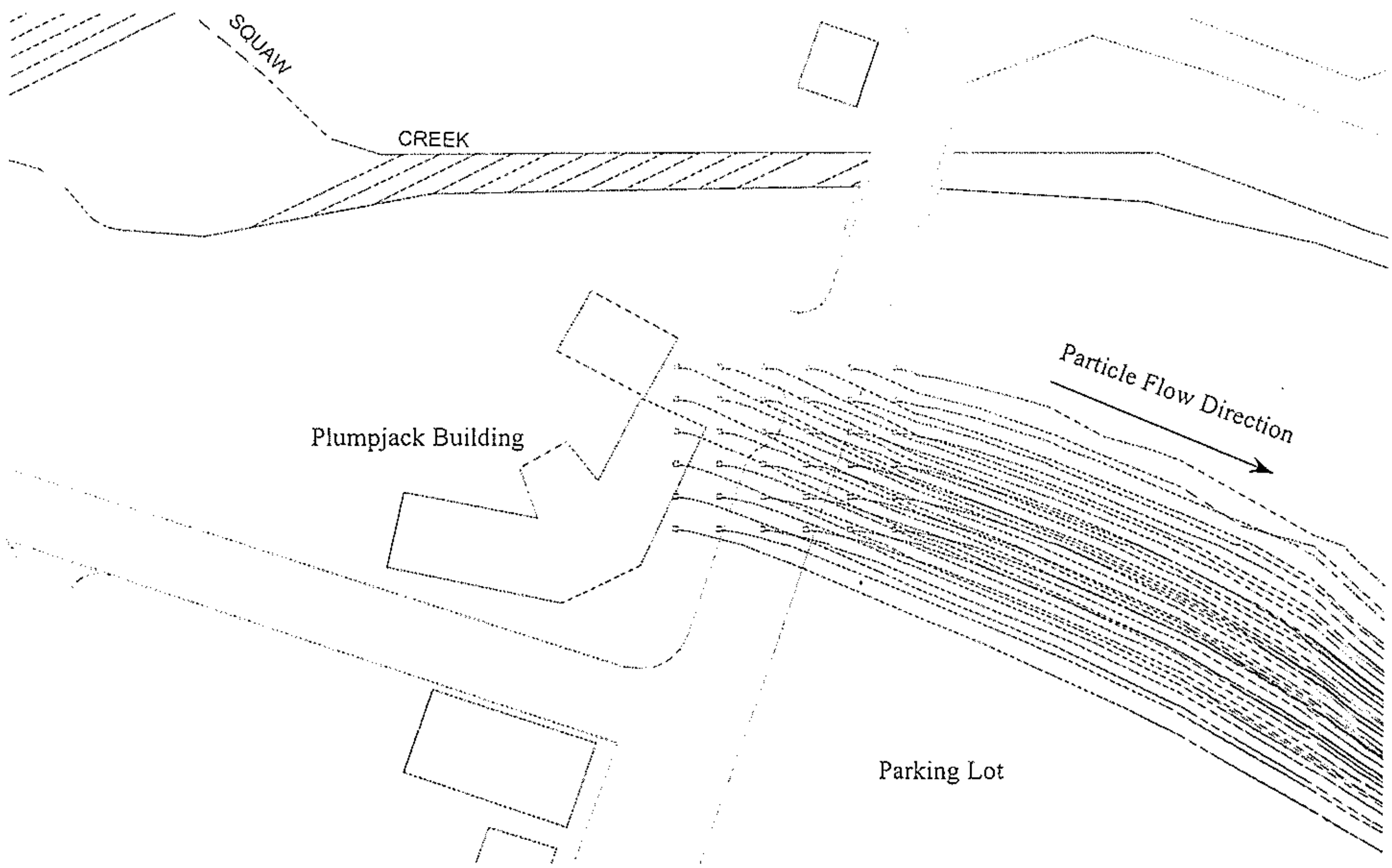
Particle Tracks from the Simulation of Scenario 3, Including Pumping the Plumpjack Well for the Plumpjack Resort and Intrawest Phases III and IV

Figure 11



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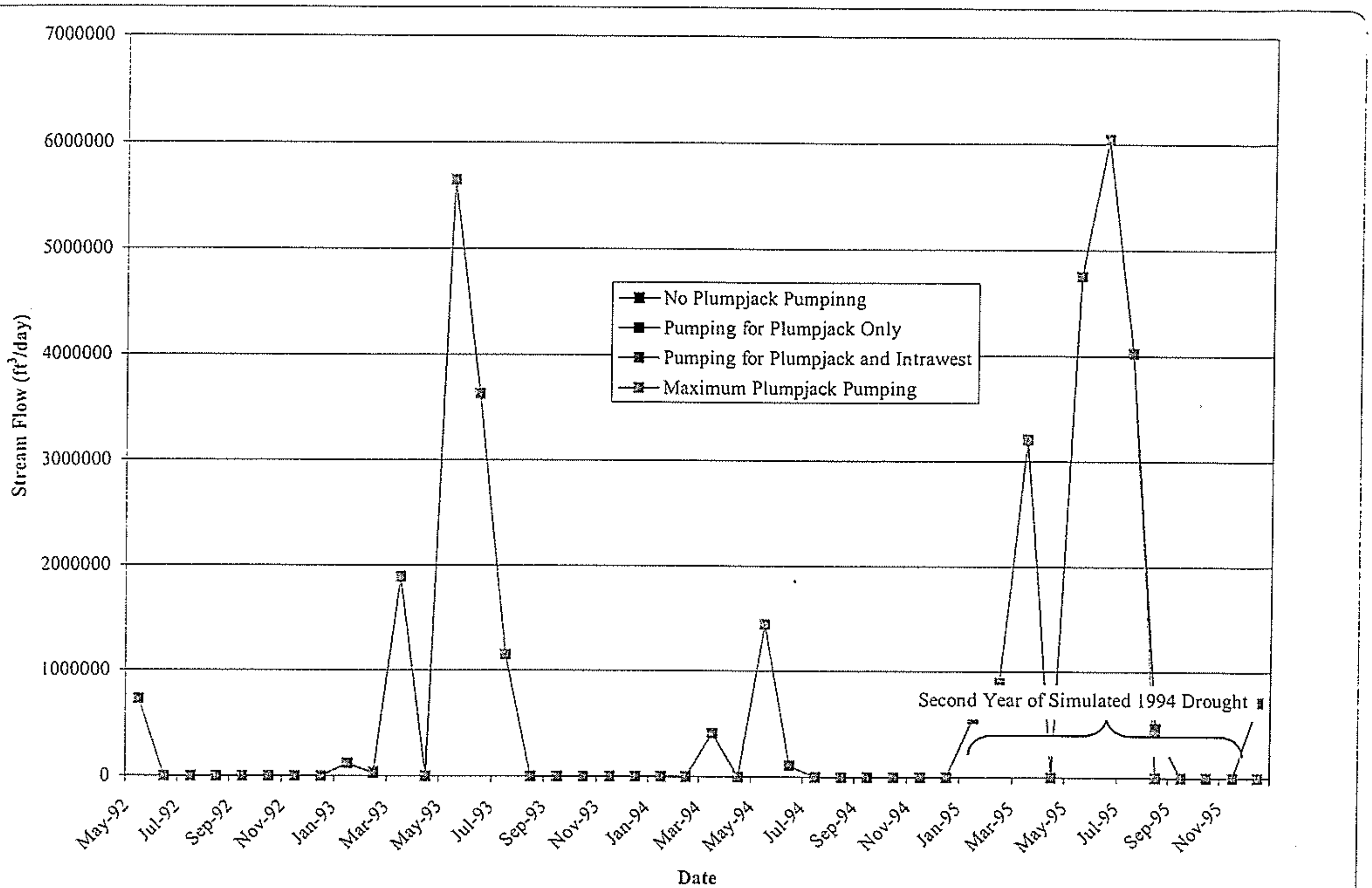
Particle Tracks from the Simulation of Scenario 4, Including Pumping the Plumpjack Well at the Maximum Pumping Rate

Figure 12



derrik williams

Simulated Stream Flows in Squaw Creek for the Four Simulated Scenarios

Figure 13

APPENDIX E

Application for Authorization to Use

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APPLICATION FOR AUTHORIZATION TO USE

RESULTS OF AQUIFER TESTING AND IMPACT ANALYSIS
PLUMPJACK IRRIGATION WELL
OLYMPIC VALLEY, CALIFORNIA

Kleinfelder, Inc.
4875 Longley Lane, Suite 100
Reno, Nevada 89502

To Whom It May Concern:

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(address)

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(Kleinfelder, Inc. project manager)

Date: